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Ministry of Natural Resources Ministère des Richesses naturelles
Ontario

CANADA /ONTARIO FLOOD DAMAGE REDUCTION PROGRAM

REGIONAL FLOOD FREQUENCY ANALYSIS FOR ONTARIO STREAMS

VOLUME 1
SINGLE STATION ANALYSIS AND INDEX METHOD
1985

S.M.A. Moin and M.A. Shaw

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Errata

Regional Flood Frequency Analysis for Ontario Streams - Volume 1

Page	Revision (use self adhesive sheet provided to update report)
(xiv)	' $a_1, a_2, \ldots B_1$ ' should read : ' $a_1, a_2, \ldots a_1$ '
(xvi)	' $r_m^3/_s$ ' should read : ' r_{cmx} '
(xvii)	Fourth line should read : ' Return period or recurrence interval in years '
(29)	This page continues from page 13
(32)	Equation (1) should read : $QPP = (QD1 + QD3)/_2 + (2QD2 - QD1 - QD3)/(1-2\alpha)$
(63)	' Langbeins' (1960) ' should read ' Condies' (1980) '
(66)	Regional Regression Equation Coefficients (for Region 5) should be :

Region	Constant C	Slope n
5	0.96	0.775

(87) Table 5.1.22 (for Region 5 data) should read :

Region Number	5
Area= 100(km^2)	
Q2	34
Q100	79
Area=1,000(km^2)	
Q2	203
Q100	474
Area=5,000(km^2)	
Q2	706
Q100	1653

(88) Items a), b),and c) should read :

a) Drainage Area = 100 km^2
Regions: (1,3,9); (2,4,5,8); (6,7)

b) Drainage Area =1,000 km^2
Regions: (1,7,9); (2,4,5,8); (3,6)

c) Drainage Area =5,000 km^2
Regions: (1,10,12); (4,5)

Fifth line from bottom of page should read :
$R_{CL} = R_{mt} \pm SE \times t$

(91) ' (SE) ' should read : ' (SE_c) '
Delete ' mean ' from ' NS = mean number '

(123) Reference No. 6 - ' Nie ' should read : ' Nix '

(A39) Last table on page - ' BASE FLOOD INDEX ' should read :
' BASE FLOW INDEX '

November 1985

CANADA/ONTARIO FLOOD DAMAGE REDUCTION PROGRAM

REGIONAL FLOOD FREQUENCY ANALYSIS FOR ONTARIO STREAMS

VOLUME I

SINGLE STATION ANALYSIS AND INDEX METHOD

S.M.A. Moin and M.A. Shaw
Water Planning and Management Branch
Inland Waters Directorate, Environment Canada

Errata (see detailed sheet for additional information)

Regional Flood Frequency Analysis for Ontario Streams - Volume 1

Page	Revision (cut out and stick over revised item at appropriate location)
(xiv)	$a_1, a_2, \ldots a_i$
(xvi)	r_{cmx}
(xvii)	Return period or recurrence interval in years
(29)	This page continues from page 13
(32)	$QPP = (QD1 + QD3)/2 + (2QD2 - QD1 - QD3)/(1-2\alpha)$
(63)	Condies' (1980)
(66)	5 0.96 0.775
(87)	34 79 203 474 706 1653
(88) a)	Regions: (1,3,9); (2,4,5,8); (6,7)
b)	Regions: (1,7,9); (2,4,5,8); (3,6)
c)	Regions: (1,10,12); (4,5)
	$R_{CL} = R_{mt} \pm SE \times t$
(91)	(SE_c)
	NS = ~~mean~~ number
(123)	Nix
(A39)	BASE FLOW INDEX

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VOLUME 3

I Single Station Flood Frequency Analysis Plots and Tables
(Figures I1.0 - I400.0 inclusive)

Legend to Symbols and Abbreviations Used

A, Area	Drainage basin area (sq. km)
ACLS	The percentage of the drainage basins area which is controlled by lakes and swamps
$a_1, a_2 \ldots B_i$	Regression coefficients
BFI	The Base Flow Index (total volume of base flows/total volume of runoff) for a drainage basin
C	A constant
m^3/s	Cubic metres per second
CV	Coefficient of variation of sample data (STD/mean)
^oC	Temperature in degrees Celsius
F	Statistic to indicate level of significance in multiple analysis
FDRPFFA	A computer program which performs computations and generates plots for FFA using four theoretical probability density functions
FFA	Single Station Flood Frequency Analysis
ISTORIC	A computer program which performs computations and generates a plot for FFA utilizing historical information to improve the fit of the theoretical probability density function for data having high outliers or a discontinuous period of record
K	Base factor of watershed used in expression to estimate peak flow from mean daily flow data
km	Kilometres
km^2	Square kilometres
LEN	Length of the main (longest) channel to the point of interest (km)
LN	Two Parameter Log Normal distribution
Log 10	Logarithm to the base 10

Legend to Symbols and Abbreviations Used

LOWOUT	A computer program which performs computations and generates a plot for FFA on data having low outliers by using statistical techniques to improve the fit of the theoretical probability distribution
m	Metres
MAR	Mean annual runoff (mm)
MAS	Mean annual snowfall (cm)
MD	Annual maximum daily mean flow
MID	Annual maximum instantaneous (peak) flow
mm	Millimetres
N	Number of annual maximum flows and also denotes natural flow data for station
	Exponent used in regional expressions derived for the Index Flood Method of RFFA
NONPARA	A computer program which employs statistical procedures to check time series data for independence, trend, homogeneity and general randomness
NTS	National Topographic Series (of maps)
OUTLIER	A computer program which employs statistical tests to identify high and low outliers
PDR	Used on station data parameter summary table (Appendix A) and indicates what probability distribution/computer program was used to fit the data (denoted A,B,C,D) and the rating given to the success of the data transform in approximating a normal distribution. The sample skew and kurtosis respectively for the transformed data are compared to the theoretical ideal values and rated on a scale of 1 to 9 (where 1 is the best) A denotes 3 PLN distribution used (FDRPFFA) B denotes 3 PLN distribution used (LOWOUT) C denotes LN distribution used (FDRPFFA) D denotes 3PLN distribution used (ISTORIC)
QMAX	Maximum flow value used in recorded data series
QMIN	Minimum flow value used in recorded data series

Legend to Symbols and Abbreviations Used

Q_T	Representative estimate of flow with a recurrence interval of T-years (no specified units)
Q2	Index Flood (m^3/s), equal to Q2; if no FFA was carried out on the data, $Q2 = \frac{1}{N}\sum_{i=1}^{i=N} Q_{Ai}$ otherwise (where Q_A is the annual maximum flood series used)
QD	Daily mean flood peak (m^3/s)
QD1,QD2,QD3	Daily mean flows (m^3/s) where QD2 is the largest flow and QD1 and QD3 occur on the day before and on the day after QD2, respectively
QP	Instantaneous flood peak (m^3/s)
QPP	Predicted instantaneous flood peak (m^3/s)
R	Regulated flow data for a station and also denotes Coefficient of Determination for Multiple Regression Analyses
R^2	Coefficient of Multiple Determination
r	Ratio of MID/MD
rm	Mean ratio of r for period of record
rmx	Maximum ratio of r for period of record
r_c	Ratio of QPP/MD
r_{cm}	Mean ratio of R_c for period of record where peaks were synthesized
$r_{m^3/s}$	Maximum mean ratio of R_c for period of record where peaks were synthesized
r_e	Estimate of rm
r_{emx}	Estimate of r_{mx}
RFFA	Regional Flood Frequency Analysis
SD,STD	Standard deviation of sample data
SE	Standard error of estimate
SHP	An index of the drainage basin shape (dimensionless)

Legend to Symbols and Abbreviations Used

SLP	Slope of the main channel determined by the travel time method
sq. km	Square kilometres
T	Return period on recurrence interval in years
3PLN	Three Parameter Lognormal distribution

1.0 SUMMARY OF RESULTS AND RECOMMENDATIONS

1.1 Summary

In 1978, the Government of Canada and Province of Ontario entered into, "An Agreement Respecting Flood Risk Mapping and Other Flood Damage Reduction Measures". This project was commissioned by the Steering Committee under the Other Measures component of the Agreement as an aid to flood risk mapping studies in Ontario. Earlier, the interim results of the Regional Flood Frequency Analysis of Ontario Streams were presented in a report form to provide input into the Province of Ontario's Hydrotechnical Guidelines which were in preparation. Volume 1 presents the findings of the first two phases of the three phase study detailing the Index Flood Method. In Volume 2, results of Phase 3, Multiple Regression Analysis are presented. Volume 3 of the report illustrates the results of Single Station Analysis. The results will be used to provide hydrologic input to flood risk mapping and related studies. The objective of the project is to develop techniques for estimating the T-year recurrence interval instantaneous flood flows for the province. Furthermore, the results from this study will also be of use in the estimation of flood flows for a variety of projects such as the design of spillways, bridges, etc.

Not all streams are gauged and it is not uncommon that many locations, where flood flow estimates are required, lack the hydrometric data needed for computation of design flows. In situations like these or at points where streamflow records are short, regional analyses are undertaken to provide techniques for estimating flood flows. Two such techniques are pursued in this study: Index Flood Method and Multiple Regression Analysis. The results obtained by the Index Flood Method are the subject of this volume.

Regional analyses develops relationships between flood flow estimates and significant physiographic and climatic parameters for gauged watersheds in hydrologically homogeneous regions.

The resulting relationships can then be used to estimate streamflows at other locations based on a knowledge of physiographic and climatic conditions.

The peak flow data base for all the streamflow stations, where no peak instantaneous flow records were available, was synthesized using proven techniques. Next, a data review was carried out and stations with natural flow or minimal regulation were selected for further analysis.

From 415 stations with more than ten years of record, 161 stations were identified as being unsuitable for use in the Index Flood Method Analysis due to the degree of regulation. Further screening, utilizing all stations, was carried out employing non-parametric statistical tests for independence, trend, homogeneity and general randomness. With a few exceptions, the data base passed these tests. For some stations, segments of data had to be dropped for the series to pass some tests. A total of 16 stations were eliminated for failing all the tests.

The annual maximum instantaneous flows at the 247 hydrometric stations were fitted to four theoretical probability distributions. By comparing the statistical coefficients of skew and kurtosis with the theoretical values, the data were found to best fit the Three-Parameter Lognormal (3PLN) distribution. When outliers were detected, a conditional Three-Parameter Lognormal distribution was employed. For some short record data, 3PLN fit was not possible. In these situations, a lognormal distribution was used.

On the basis of homogeneity tests carried out, the province was divided into twelve regions for the purpose of developing a regional or index curve. Of the twelve regions, seven regions are in the south, two in the east and three in the north.

Nine stations out of the 247 selected were set aside for testing of the methodology. The Index Flood Method was applied to these nine stations treating them as ungauged watersheds.

Similarly, representative stations in various regions which were initially left out due to regulation were inspected and those with minor regulation tested to see the robustness of the equations. Generally, it was found that the Index Flood Method predicted acceptable results when these were compared with the single stations analyses for the test watershed.

To evaluate the impact of abstraction errors of each physiographic and hydrometeorologic parameter, a sensitivity analysis was carried out. This exercise limits the allowable errors during the data abstraction phase.

It should be noted that the equations and graphical relationships were developed using a streamflow data base which can be considered as representative of the natural or quasi-natural state. To study the impact of manmade changes on the hydrologic regime such as reservoirs, diversions, urban watersheds, etc. would require alternative techniques.

Another note of emphasis is that the regression equations and graphical relations were developed employing a certain range of data. Hence, these relations should be used only when the parameters of the equation are within the ranges noted in Chapters 5 and 6. Caution and consideration are in order even when the parameters fall near either extreme.

An additional feature was added to this study in terms of including the expected probability concept in the regional analysis. This method allows for the short length of data and computes the average of all probability exceedances. It is emphasized that incorporation of the expected probability technique is a policy decision and not demonstrated as a better alternative.

Based on residual errors among other factors, the province was divided into three regions for carrying out Multiple Regression Analysis. Four equations relating T-year flood with basin physiographic and climatic variables were developed; one equation was for the entire province and one each for the three regions.

1.2 Recommendations

Based on the analysis of the study results and conclusions detailed in the foregoing, the following is recommended:

1. The procedure described in the study should be used for estimating flood flows;

2. When estimating design flows for drainage basins that are close to the regional boundaries, flow relationships for the adjoining homogeneous regions should be used. It is possible that the flows generated may differ significantly. In such situations, use should be made of the regional relationship for the region exhibiting similar hydrologic and climatic characteristics to that of the drainage basin in question;

4. Caution should be exercised when estimating flows for small drainage areas ($<$20 sq km) and for areas on the regional curve with less than adequate coverage;

5. Estimates should not be made using the regional relationships derived in this study for urbanized and urbanizing watersheds as these conditions do not represent the average hydrologic characteristics of a region - Region 8 is probably an exception in this case for medium size drainage areas ($>$100 sq km);

6. The Multiple Regression Method detailed in Volume 2 should be used to estimate the flood flows if the physiographic and hydrometeorlogic parameters required in the equations can be estimated reliably for the ungauged watershed of interest. That flow should be subsequently checked using the Index Flood Method;

7. If maximum instantaneous flow data is not available at a gauged station for the full period of record, or at all, the available maximum mean daily flow data prior to peak data collection should be converted to peak data using the methodology described in the study;

8. Future studies incorporating additional years of flow data should utilize the synthethized peak data computed for this study;

9. Additional hydrometric stations are required in several regions to improve the reliability and range of application of the regional relationships. This deficiency is quite acute in Southwest Ontario and the Niagara Penninsula;

10. Further studies should be undertaken to investigate flood frequency due to ice jams and in urbanizing watersheds;

11. It is recommended that additional streamflow gauges be set up for small to medium size ($<$ 150 sq km) urbanizing watersheds. A similar effort should be directed for small watersheds where tile drainage is being installed. Temporary gauges may also be of significant importance for watersheds where major forest fires have changed the hydrologic regime; and

12. It is also recommended that the information contained in the streamflow gauge registers of Water Resources Branch of Environment Canada be enhanced. Additional documentation for the gauges would require the collection of data for gauges which are classified as regulated. Such information may include but not be limited to the following:
    - nature of regulation (natural or manmade)
    - degree of regulation (active lake or reservoir volume vs volume of a base flood)
    - surface area of the reservoir in comparison with the drainage area regulated
    - height of conservation storage

    If the lake or reservoir operating agency can be contacted, the rule curves should also be kept in the gauge registers.

2.0 INTRODUCTION

2.1 General

The Government of Canada and the Province of Ontario entered into, " An Agreement Respecting Flood Risk Mapping and Other Flood Damage Reduction Measures" in 1978. The objectives of this agreement are to identify flood risk areas, reduce flood damage and risk to life by discouraging new development in flood risk areas and find feasible ways of reducing future flood damage to existing development.

An Agreement Respecting Flood Risk Mapping and Other Flood Damage Reduction Measures provides for the establishment of a Steering Committee and a Technical Sub-Committee. The Steering Committee is responsible for general administration of the agreement. The Technical Sub-Committee provides technical support to the Steering Committee. This study was carried out under the general guidance of the Technical Sub-Committee. In addition, an Advisory Committee was created with representatives from Water Resources Branch, Ottawa (WRB/OT), Water Planning and Management Branch, Ottawa (WPMB/OT), the National Hydrology Research Institute, Ottawa (NHRI), and the Conservation Authority and Water Management Branch, Ontario Ministry of Natural Resources (CAWM/OMNR)

There are four major components in producing flood risk maps. These are hydrology, hydraulics, mapping and public information. The hydrologic analyses provide the magnitude and frequency of flood flows. These flows are then employed in a hydraulic investigation to determine the elevations to which the water will rise during the design flood. The computed elevations are plotted on engineering maps and subsequently, information flood risk maps are prepared for public dissemination.

Design flood flows can be estimated by several methods. Any particular technique employed in a given situation depends on a number of factors, including data availability. When inadequate data exists other procedures, such as hydrologic (rainfall-runoff) mathematical modelling or Regional Flood Frequency Analysis are undertaken to develop design flood flows.

Regional Flood Frequency Analyses employs the streamflow data for all natural or quasi-natural flow at hydrometric stations in a given area. The two regional analyses techniques, Index Flood Method and Multiple Regression Analysis are used. The Index Flood Method, utilizing a regional dimensionless frequency curve, requires that homogeneity tests be performed and generate a mean annual flood versus drainage area relationship. Regression analyses are undertaken to develop equations relating various quantifiable physiographic and hydrometeorologic parameters to T-year flood flows at the sites having hydrometric records. These equations and relationships are then used to estimate flood flows for ungauged watersheds or for a basin with an inadequate data base.

2.2 Purpose and Organization

The purpose of this study is to develop methodologies for estimating flood flows by frequency analysis for streams in Ontario. Towards this objective, Water Planning and Management Branch, (WPMB), Inland Waters Directorate (Ontario Region), Environment Canada developed a work program in February 1983 to complete a regional flood analysis for the Province of Ontario. This work program was subsequently discussed with other interested agencies and Terms of Reference were derived which incorporated the interests of all agencies. An Advisory Committee was formed with representatives from WPMB/OT, WRB/OT, NHRI and CAWM/OMNR to review study progress and provide advice at milestones during the study. Water Planning and Management Branch had already undertaken some preliminary frequency analyses in addition to developing part of the physiographic data base.

2.3 Terms of Reference

2.3.1 Scope

A brief description of the individual tasks is as follows:

TASK 1:

Requires the development of single station flood peak frequency curves using annual maximum flood peak series at suitable hydrometric stations with the study area. Efforts will be made to use the peak instantaneous series by using the information where available and by converting maximum daily series. Where necessary, stations with regulation and natural flow will be grouped and impact of regulation defined.

TASK 2:

Requires the identification and delineation of homogeneous flood regions utilizing statistical and non-statistical techniques. Among non-statistical methods, identification by geomorphological development will be stressed.

TASK 3:

Requires the development of functional relationships for evaluating the 2 year (index) flood; 5, 10, 20, 50 and 100 year flood peaks from appropriate physiographic parameters. The physiographic parameters used must be clearly stated. In addition, regions for which no definable functional relationships could be produced must be identified.

Each of the tasks described above contains activity elements. These activities are identified in Task 2 of Section 2.3.2.

2.3.2 Methodology

TASK 1 - Activity Elements

1-A Review the hydrometric data base employed by Inland Waters Directorate, Ontario Region (IWD, OR). Stations with less than 10 years of record will not be considered but may be used as a check on any regression equations developed.

1-B Group the stations with respect to the degree of regulation viz natural flow and no regulation, minor regulation due to lakes and reservoirs and major regulation.

1-C Review the procedure used by IWD, OR for converting daily maximum flows to peak instantaneous flows. If necessary, convert daily maximum flows to peak instantaneous flows. Where a station has part manual, part recorder record, check converted maximum daily flows against peaks for homogeneity.

1-D If possible and necessary, remove the effects of regulation from any portions of the hydrometric data base.

1-E Set up computer programs NONPARA, OUTLIER, LOWOUT, FDRPFFA and ISTORIC.

1-F Subject the data sets to tests for independence, trend, homogeneity and general randomness in order to screen the data prior to performing frequency analysis and perform frequency analysis by using FDRPFFA.

1-G Using program OUTLIER to determine the nature of outliers.

1-H Undertake frequency analysis using FDRPFFA, LOWOUT, ISTORIC or NEGSKEW as appropriate.

1-J Prepare a preliminary report on Task 1 activities.

TASK 2 - Activity Elements

2-A Review the physiographic and hydrometric data and determine the procedure for delineating homogenous regions. Test homogeneity using statistical tests.

2-B Develop curves for the 2-year, 5-year, 10-year, 20-year 50-year and 100-year recurrence intervals. Develop relationships based on 2-year (index) flood, drainage area, and any other significant independent variables.

2-C Compare the results of this study and the results of other studies in Ontario.

2-D Develop procedures for estimating flood flows on both gauged and ungauged streams giving examples. Perform sensitivity tests and document the parameters in the order of importance.

2-E Prepare a preliminary report on Task 2 activities.

TASK 3 - Activity Elements

3-A Update the physiographic data base. A significant amount of work for the physiographic data base has been undertaken by IWD, OR.

The data presently compiled for 47 watersheds (list attached) include drainage area (planimetered and Water Survey of Canada values), total length of tributary streams (from which the drainage density factor was computed), length of main channel, relief, length to the centre of area and stream slopes by four different methods.

If required and necessary, the physiographic data base should be expanded. In addition, parameters like depth of overburden and areas of lakes and bogs should be computed for the existing watersheds. All the watersheds for which the data were compiled were gauged.

3-B For each of the watersheds determine the most appropriate theoretical frequency distribution by comparison of skew coefficient and kurtosis for longterm stations with theoretical values.

3-C Perform regression analyses for relating various return flows with basin physiographic and meteorological parameters. Use standard regression procedures with transformations if needed.

3-D Develop regression curves for areas identified in 2-A. Indicate the limits for which the curves could be extrapolated.

The Multiple Regression Analysis and findings of the study are described in Volume 2 of the report.

3.0 FLOODS IN ONTARIO

3.1 General

Ontario has had a long history of floods ranging from minor in extent to catastrophic. Floods in Ontario are the result of one or more of the following factors: snowmelt, spring rainfall storms, summer thunderstorms, tropical storms (hurricanes) and ice jams. This report considers only open water floods.

The most severe flooding on record in Ontario occurred in October 1954 as the result of Hurricane Hazel passing over the Toronto area. The flooding took 81 lives and caused about $7.5 million damage on the Humber and Don Rivers. The passage of a hurricane through Ontario is a rare event since the normal path of hurricanes is to the southeast; however, the southern portion of the province does occasionally feel the effects of passing hurricanes.

Spring rainfall events are a common generator of floods. One such occurrence that resulted in heavy damage occurred in May 1974. This occurred over the Grand River Basin and resulted in about $8 million in damages with the community of Cambridge being the hardest hit.

Spring snowmelt is another major cause of floods in Ontario. Often the snowmelt is accompanied by rainfall which can accelerate the melt and add to the runoff.

Thunderstorms are a common occurrence throughout the province. In the southern areas, these storms often pass over the Great Lakes and carry a heavy load of moisture. The storms are frequently very intense but relatively short in duration and small in areal coverage. Flooding from these storms does not usually extend beyond small drainage basins. A severe thunderstorm in September 1981 resulted in significant flooding in the Windsor area.

3.2 Flood Generating Mechanisms

3.2.1 Climatic Factors

The climate of Ontario exhibits a wide range of characteristics. The southern and central portions of the province fall under the influence of the Great Lakes to a varying degree but this influence disappears in the northern areas. The mean annual temperature ranges from 9.5°C in the extreme south to -6°C in the north. The range of temperatures in the south is smaller due to the moderating effects of the Great Lakes.

Precipitation also varies dramatically from area to area. On the leeward side of Lakes Huron and Superior, the annual precipitation exceeds 1000 millimetres, while the northwest corner of the province has less than 500 millimetres annually. Figure 3-1 shows the precipitation patterns for the province. On average, about 33 percent of the precipitation falls in the form of snowfall. This percentage is relatively constant throughout the northern and central areas but drops off sharply in the southern and southeastern areas. Snowfall ranges from a low of less than 100 centimetres along the northern shore of the western end of Lake Erie to a high of over 300 centimetres along the eastern side of Lake Superior and Georgian Bay and in the Kapuskasing-Timmins -Hornepayne area.

3.2.2 Physiographic Factors

The province is divided into three major physiographic areas: the Hudson Bay Lowland in the northeastern region; the Canadian Shield, which runs from the northwest of the province through the central region; and the Great Lakes-St. Lawrence Lowland in the southern region.

4.0 SINGLE STATION ANALYSES

4.1 Flow Data

4.1.1 General

Flow data to December 31, 1982 collected by Water Survey of Canada, its predecessors, and cooperating agencies, were utilized in this study. Records of all Ontario stations for daily mean flows, annual maximum flows, and annual peak instantaneous flows were provided on magnetic tape by Water Resources Branch, Environment Canada. Data published by the Ontario Ministry of the Environment for nineteen stations set up in 1965 under the International Hydrological Decade Program were also used in this study.

Pre and post-processor computer programs were developed to manipulate the data for use in the other computer programs required for the analyses. As previously mentioned, annual maximum daily mean flows (MD) and annual maximum instantaneous peak flows (MID) were obtained.

The former data (MD) were based on one or more observations taken over a period of one day if a manual gauge was used. The latter data (MID) were based on a continuous record from which the maximum instantaneous value for a period of one day was extracted. This record was also used to determine the mean flow value for that same period. The maximum value of these daily observations for each year comprise the annual series. The annual maximum instantaneous flood is more useful for the design flood estimation as it generally represents the highest flood stage encountered at a given location; however, this data was not always available and often covered only the latter portion of the station's period of record.

Usually the period of record covered solely by MD data was longer than that of the period of MID data. It was estimated that over 50% of the available data had MD data only. Various methods were investigated to enable estimation of the MID using available MD data when only MD data were available, and a method promulgated by Sangal (1981) was adapted for this purpose and used in this study. The methodology used is described in Section 4.1.2. A few stations had incomplete years of daily flow data taken mainly during the snowmelt periods of the year (i.e. seasonal gauges). These were utilized if it was reasonable to expect the maximum flows to occur during such periods. Nearby gauges with complete records were used, if available, to confirm regional trends. Also considered were watershed size and degree of urbanization.

4.1.2 Data Selection

All stations having five or more years of MID data were selected for the analyses. Additional stations having five to nine years of MD data were selected in regions where it was desirable to increase the range and extent of the data and provide better areal coverage. Data from these stations were converted to MID using the techniques described in Section 4.1.3.2.

A total of 482 stations were selected, including 67 stations having less than ten years of data. All stations classified by Water Survey Canada as having discharge affected by upstream regulation were reviewed in order to reclassify them according to the magnitude of the effects regulation had on the flood flows. This is discussed in Section 4.1.5. Stations identified as having severe regulation were not included in the Regional Flood Frequency Analysis (Section 5.0). Regulated stations which had at least ten years of natural flow data prior to commencement of regulation were analyzed by splitting the record into separate natural and regulated series.

The records of some other stations were also split for reasons discussed in Section 4.1.4.1. Several years of data had to be removed from samples of some stations to satisfy nonparametric test criteria. This is also discussed in Section 4.1.4.1. After preliminary editing for the Regional Flood Frequency Analysis (RFFA) data base, a total of 9700 station years of data remained, including 625 station years contributed by stations having less than ten years of records or those which failed the nonparametric data tests. (Denoted as "< /F" stations in Table 4.1.0). Single station flood frequency analyses were carried out for all the selected stations and the results of these analyses are included in Appendix E. After removal of the heavily regulated stations from the RFFA data base, a total of 5800 station years of data remained, including 530 station years from the stations denoted "< /F".

Several stations in the Grand River Basin that are classified as being heavily regulated were converted by Minshall (1983) to natural flow conditions using a combination of reverse reservoir routing and hydrologic routing (Muskingum Method). This "naturalized" data were abstracted from that technical report and used in place of the regulated data as shown on Table 4.1.0.

TABLE 4.1.0

LIST OF STATIONS AND NOTES ON DATA USED FOR STUDY

SHEET 1 OF 12

(SEE SHEET 12 FOR LEGEND TO SYMBOLS USED IN TABLE)

STATION NAME	U.S.C. NO.	PERIOD OF RECORD AND NOTES ON DATA USED 1910 1920 1930 1940 1950 1960 1970 1980	NOTES
- ABITIBI RIVER AT ABITIBI CANYON	-04ME002		R3
- ABITIBI RIVER AT IROQUOIS FALLS	-04MC001		L R3
- ABITIBI RIVER AT ISLAND FALLS	-04ME001		L R3
- ABITIBI RIVER AT OHAKAWANA	-04ME003		R3
- ABITIBI RIVER AT OTTER RAPIDS	-04ME004		H R3
- ABITIBI RIVER AT TWIN FALLS	-04MC002		R4
- ALBANY RIVER ABOVE HOTTIK ISLAND	-04GD001		D H R4
- ALBANY RIVER BELOW ACHAPI LAKE	-04GC002		H R4
- ALBANY RIVER NEAR HAT ISLAND	-04HA001		R3
- ALDER CREEK NEAR NEW DUNDEE	-02GA030		R1
- ANABLE DU FOND RIVER AT SAMUEL CHAMPLAIN PROVINCIAL PARK	-02JE019		R3
- ASHEWEIG RIVER ABOVE LONG DOG LAKE	-04DB002		N
- ASHEWEIG RIVER AT STRAIGHT LAKE	-04DB001		D N
- ATTAWAPISKAT R. BELOW ATTAWAPISKAT LAKE	-04FB001		L N
- ATTAWAPISKAT RIVER BELOW MUKETEI RIVER	-04FC001		D N
- AUSABLE RIVER NEAR SPRINGBANK	-02FF002		L N
- AUX SABLES RIVER AT MASSEY	-02CE002		R2
- AVON RIVER BELOW STRATFORD	-02GD018		R2
- BAILEY CREEK NEAR BEETON	-02ED004		L R1
- BASSWOOD RIVER NEAR WINTON	-05PA012		L R2
- BATCHAWANA RIVER NEAR BATCHAWANA	-02BF001		N
- BATFIELD RIVER NEAR VARNA	-02FF007		N
- BEAR BROOK NEAR BOURGET	-02LB008		N
- BEAR CREEK ABOVE WILKESPORT	-02GG004		N
- BEAR CREEK NEAR PETROLIA	-02GG006		N
- BEAVER CREEK NEAR MARMORA	-02HK006		F R
- BEAVER RIVER ABOVE EUGENIA POWER HOUSE	-02FB001		R3
- BEAVER RIVER NEAR CLARKSBURG	-02FB009		L R3
- BEAVER RIVER NEAR KIMBERLEY	-02FB003		R3
- BEAVERTON RIVER NEAR BEAVERTON	-02EC011		L N
- BEETON CREEK NEAR TOTTENHAM	-02ED100		R2
- BENNET CREEK AT SAULT STE. MARIE	-02BF003		(N
- BIG CREEK NEAR DELHI	-02GC006		R2
- BIG CREEK NEAR KELVIN	-02GC011		L R1
- BIG CREEK NEAR WALSINGHAM	-02GC007		H R1
- BIG OTTER CREEK ABOVE OTTERVILLE	-02GC017		R2
- BIG OTTER CREEK AT TILLSONBURG	-02GC010		R2
- BIG OTTER CREEK NEAR CALTON	-02GC026		(N
- BIG OTTER CREEK NEAR VIENNA	-02GC004		R1
- BIGHEAD RIVER NEAR MEAFORD	-02FB010		L R1
- BLACK CREEK NEAR WESTON	-02HC027		D N
- BLACK RIVER AT BALDWIN	-02EC008		(N
- BLACK RIVER AT SUTTON	-02EC012		R2
- BLACK RIVER NEAR ACTINOLITE	-02HL003		D R3
- BLACK RIVER NEAR MARATHON	-02BB002		L N

TABLE 4.1.0

SHEET 2 OF 12

LIST OF STATIONS AND NOTES ON DATA USED FOR STUDY

STATION NAME	U.S.C. NO.	PERIOD OF RECORD AND NOTES ON DATA USED 1910 1920 1930 1940 1950 1960 1970 1980	NOTES
- BLACK RIVER NEAR WASHAGO	-02EC002		L N
- BLACK STURGEON RIVER AT HIGHWAY NO.17	-02AC002		N R3
- BLACKWATER RIVER AT BEARDMORE	-02AD010		F N
- BLANCHE RIVER ABOVE ENGLEHART	-02JC008		D N
- BLANCHE RIVER AT SWASTIKA	-02JC009		F N
- BLOOMFIELD CREEK AT BLOOMFIELD	-02HE001		F N
- BLUE SPRINGS CREEK NEAR EDEN MILS	-02GA031		D R1
- BOB CREEK NEAR MINDEN	-02HF004		< N
- BONNECHERE R. NEAR CASTLEFORD (1922-57)	-02KC009		R3
- BONNECHERE R. NEAR CASTLEFORD (1963-82)	-02KC009		D R3
- BOWMANVILLE CK. NEAR ENNISKILLEN	-02HD212		< N
- BOWMANVILLE CK. (HAYDON TRIB.) NEAR HAMPTON	-02HD214		D N
- BOWMANVILLE CK. (TYRONE TRIB.) NEAR HAMPTON	-02HD213		< N
- BOWMANVILLE CREEK AT BOWMANVILLE	-02HD006		N R2
- BOWMANVILLE CREEK NEAR ENFIELD	-02HD211		DHL N
- BOYLE DRAIN NEAR ATWOOD	-02FE010		N
- BOYNE RIVER AT EARL ROWE PARK	-02ED102		N
- BRIGHTSAND RIVER AT MOBERLEY	-04GB005		< N
- BRONTE CREEK AT PROGRESTON	-02HB016		< R3
- BRONTE CREEK NEAR ZIMMERMAN	-02HB011		R2
- BURNT RIVER NEAR BURNT RIVER	-02HF003		D L R2
- CANAGAGIGUE CREEK NEAR ELMIRA	-02GA023		L R3
- CANAGAGIGUE CREEK NEAR FLORADALE	-02GA036		N
- CANARD RIVER NEAR LUKERVILLE	-02GH003		< N
- CARP RIVER NEAR KINBURN	-02KF011		N
- CARRICK CREEK NEAR CARLSRUHE	-02FC011		N
- CASTOR RIVER AT RUSSELL	-02LB006		L N
- CAT RIVER BELOW WESLEYAN LAKE	-04GA002		N N
- CATFISH CREEK NEAR SPARTA	-02GC018		N
- CEDAR CREEK AT WOODSTOCK	-02GD011		R2
- CEDAR RIVER BELOW WABASKANG LAKE	-05QE008		N
- CHIPPEWA CREEK AT NORTH BAY	-02DD014		< N
- CHUKUNI RIVER NEAR EAR FALLS	-05QC001		N L R3
- CLARE RIVER NEAR BOGART	-02HL102		< N
- CLYDE RIVER AT GORDON RAPIDS	-02KF013		R3
- CLYDE RIVER NEAR LANARK	-02KF010		L R3
- COLD CREEK NEAR BOLTON	-02HC023		D L N
- COLDWATER RIVER AT COLDWATER	-02ED007		N
- COLLINS CREEK NEAR KINGSTON	-02HM005		D N
- COMMANDA CREEK NEAR COMMANDA	-02DD015		< N
- CONESTOGO RIVER ABOVE DRAYTON	-02GA039		N
- CONESTOGO RIVER AT DRAYTON	-02GA017		L N
- CONESTOGO RIVER AT GLEN ALLAN	-02GA028		R3
- CONESTOGO RIVER NEAR CONESTOGO	-02GA013		R3
		1910 1920 1930 1940 1950 1960 1970 1980	NOTES

TABLE 4.1.0

SHEET 3 OF 12

LIST OF STATIONS AND NOTES ON DATA USED FOR STUDY

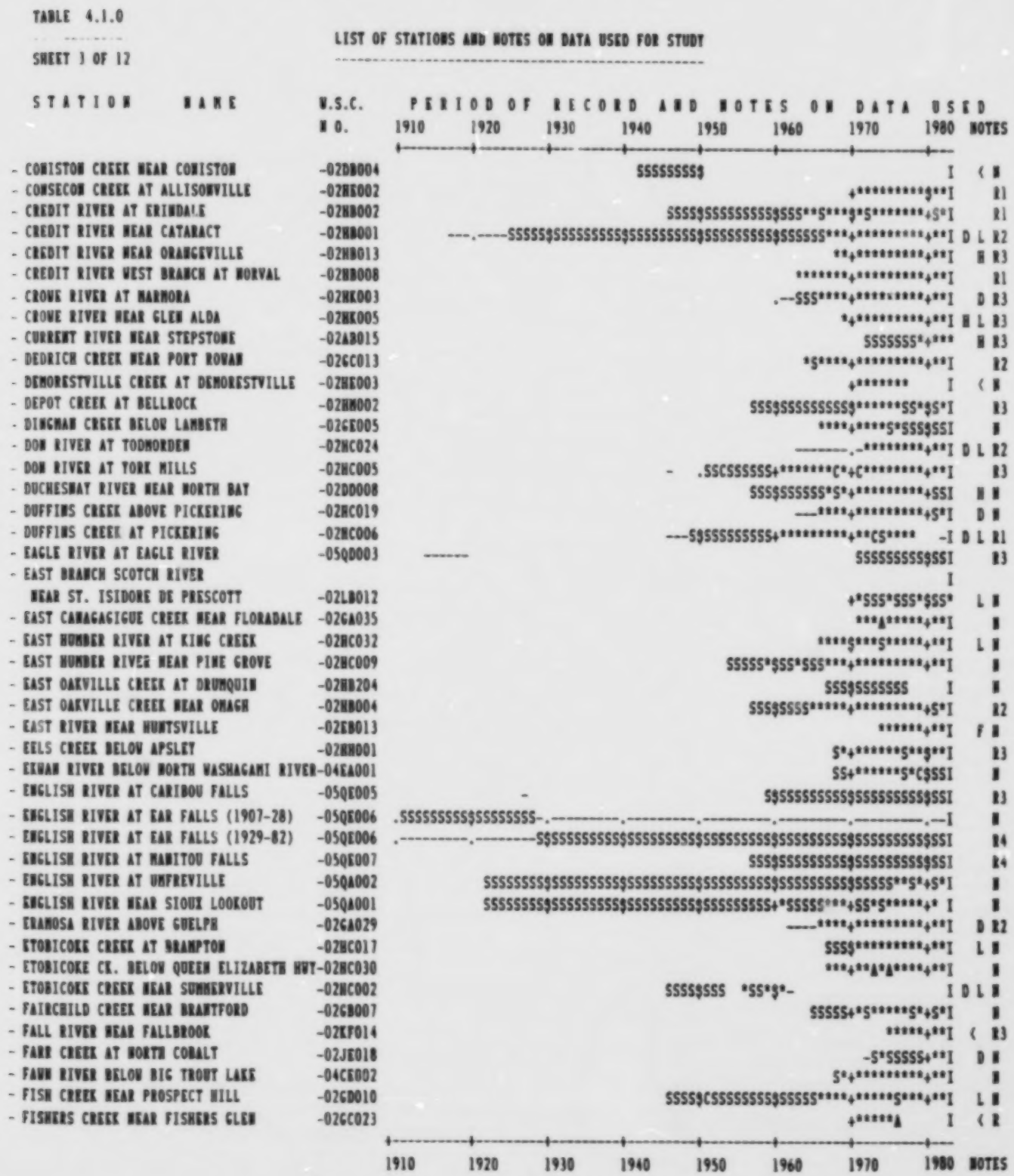

STATION NAME
W.S.C. NO.
PERIOD OF RECORD AND NOTES ON DATA USED
1910
1920
1930
1940
1950
1960
1970
1980
NOTES
- CONISTON CREEK NEAR CONISTON -02DB004
- CONSECON CREEK AT ALLISONVILLE -02HE002
- CREDIT RIVER AT ERINDALE -02HB002
- CREDIT RIVER NEAR CATARACT -02HB001
- CREDIT RIVER NEAR ORANGEVILLE -02HB013
- CREDIT RIVER WEST BRANCH AT NORVAL -02HB008
- CROWE RIVER AT MARMORA -02HK003
- CROWE RIVER NEAR GLEN ALDA -02HK005
- CURRENT RIVER NEAR STEPSTONE -02AB015
- DEDRICK CREEK NEAR PORT ROWAN -02GC013
- DEMORESTVILLE CREEK AT DEMORESTVILLE -02HE003
- DEPOT CREEK AT BELLROCK -02HH002
- DINGMAN CREEK BELOW LAMBETH -02GE005
- DON RIVER AT TODMORDEN -02HC024
- DON RIVER AT YORK MILLS -02HC005
- DUCHESNAY RIVER NEAR NORTH BAY -02DD008
- DUFFINS CREEK ABOVE PICKERING -02HC019
- DUFFINS CREEK AT PICKERING -02HC006
- EAGLE RIVER AT EAGLE RIVER -05QD003
- EAST BRANCH SCOTCH RIVER NEAR ST. ISIDORE DE PRESCOTT -02LB012
- EAST CANAGAGIGUE CREEK NEAR FLORADALE -02GA035
- EAST HUMBER RIVER AT KING CREEK -02HC032
- EAST HUMBER RIVER NEAR PINE GROVE -02HC009
- EAST OAKVILLE CREEK AT DRUMQUIN -02HB204
- EAST OAKVILLE CREEK NEAR OMAGH -02HB004
- EAST RIVER NEAR HUNTSVILLE -02EB013
- EELS CREEK BELOW APSLEY -02HH001
- EKWAN RIVER BELOW NORTH WASHAGAMI RIVER -04EA001
- ENGLISH RIVER AT CARIBOU FALLS -05QE005
- ENGLISH RIVER AT EAR FALLS (1907-28) -05QE006
- ENGLISH RIVER AT EAR FALLS (1929-82) -05QE006
- ENGLISH RIVER AT MANITOU FALLS -05QE007
- ENGLISH RIVER AT UNDREVILLE -05QA002
- ENGLISH RIVER NEAR SIOUX LOOKOUT -05QA001
- ERAMOSA RIVER ABOVE GUELPH -02GA029
- ETOBICOKE CREEK AT BRAMPTON -02HC017
- ETOBICOKE CK. BELOW QUEEN ELIZABETH HWY -02HC030
- ETOBICOKE CREEK NEAR SUMMERVILLE -02HC002
- FAIRCHILD CREEK NEAR BRANTFORD -02GB007
- FALL RIVER NEAR FALLBROOK -02KF014
- FARR CREEK AT NORTH COBALT -02JE018
- FAWN RIVER BELOW BIG TROUT LAKE -04CE002
- FISH CREEK NEAR PROSPECT HILL -02GD010
- FISHERS CREEK NEAR FISHERS GLEN -02GC023

TABLE 4.1.0

LIST OF STATIONS AND NOTES ON DATA USED FOR STUDY

SHEET 4 OF 12

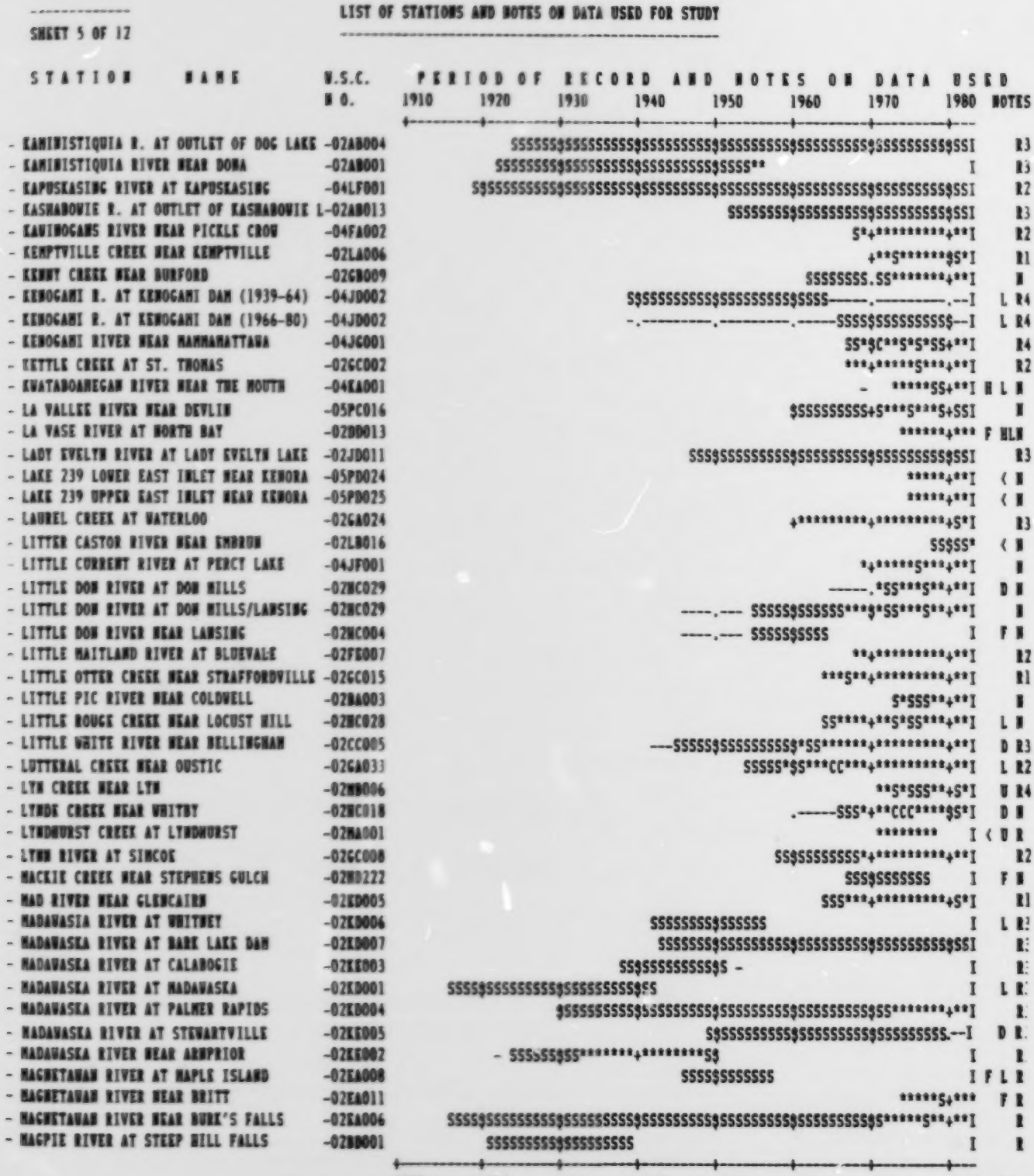
STATION NAME	W.S.C. NO.	PERIOD OF RECORD AND NOTES ON DATA USED 1910 1920 1930 1940 1950 1960 1970 1980	NOTES
- FREDERICK HOUSE R. AT FREDERICK HOUSE LAKE DAM	-04MD002		R3
- FRENCH RIVER AT DRY PINE BAY	-02DD010		R3
- FRENCH RIVER AT FRENCH RIVER	-02DD004		H R3
- FRENCH RIVER AT LAKE NIPISSING	-02DD007		H L R3
- GANARASKA RIVER NEAR DALE	-02HD002		D H
- GANARASKA RIVER ABOVE DALE	-02HD012		(H
- GANARASKA RIVER NEAR OSACA	-02HD003		R1
- GOULAIS RIVER NEAR SEARCHMONT	-02BF002		H
- GRAND RIVER AT BELLWOOD	-02GA001		H
- GRAND RIVER AT BRANTFORD (1948-79)	-02GB001		H
- GRAND RIVER AT BRANTFORD (1948-82)	-02GB001		R3
- GRAND RIVER AT CONESTOGO	-02GA002		H
- GRAND RIVER AT GALT (1914-42)	-02GA003		H
- GRAND RIVER AT GALT (1914-79:43-79 NAT)	-02GA003		H
- GRAND RIVER AT GALT (1943-79)	-02GA003		H
- GRAND RIVER AT GALT (1943-82)	-02GA003		L R3
- GRAND RIVER AT WALDEMAR	-02GA022		L R2
- GRAND RIVER AT WEST MONTROSE	-02GA034		R3
- GRAND RIVER AT YORK	-02GB002		H L R1
- GRAND RIVER BELOW SHAND DAM	-02GA016		R3
- GRAND RIVER BELOW SHAND DAM (1948-79)	-02GA016		H
- GRAND RIVER NEAR MARSVILLE	-02GA014		D H R3
- GRAVEL RIVER NEAR CAVERS	-02AE001		(H
- GREEN WATER C. AT OUT. OF GREEN WATER L	-02AB012		R3
- GRINDSTONE CREEK NEAR ALDERSHOT	-02HB012		D H
- GROUNDHOG RIVER AT FAUQUIER	-04LD001		R2
- GROUNDHOG RIVER AT NORWOOD LAKE	-04LC001		H R3
- GULL RIVER AT NORLAND	-02HF002		R3
- HARRIS RIVER AT HIGHWAY NO.69	-02EA013		(H
- HEMLOCK CREEK NEAR PORT BURWELL	-02GC025		(R
- HIGHLAND CREEK NEAR WEST HILL	-02HC013		H H
- HOLLAND RIVER AT HOLLAND LANDING	-02ED009		H H
- HORNER CREEK NEAR PRINCETON	-02GB006		L R1
- HUMBER RIVER AT ELDER MILDS	-02HC025		H H
- HUMBER RIVER AT WESTON	-02HC003		H H R1
- HUMBER RIVER AT WOODBRIDGE	-02HC011		(H
- HUMBER RIVER NEAR CEDAR MILLS	-02HC012		R1
- INDIAN RIVER NEAR BLAKENEY	-02KF012		R3
- INDIAN RIVER NEAR PEMBROKE	-02KC014		H
- JACKSONS CREEK AT PETERBOROUGH	-02HJ001		H H
- JOCK RIVER NEAR RICHMOND	-02LA007		H
- JUNCTION CREEK AT SUDBURY	-02CF005		R2
- JUNCTION CREEK BELOW KELLEY LAKE	-02CF012		(H
- KABINAKAGAMI RIVER AT HIGHWAY NO. 11	-04JA002		L H
- KAMINISTIQUIA R. AT KAKABEKA FALLS P.H.	-02AB010		R3
- KAMINISTIKWIA RIVER AT KAMINISTIKWIA	-02AB006		R3

1910 1920 1930 1940 1950 1960 1970 1980 NOTES

TABLE 4.1.0

SHEET 5 OF 12

LIST OF STATIONS AND NOTES ON DATA USED FOR STUDY



STATION NAME	W.S.C. NO.	PERIOD OF RECORD AND NOTES ON DATA USED (1910 1920 1930 1940 1950 1960 1970 1980)	NOTES
- KAMINISTIQUIA R. AT OUTLET OF DOG LAKE	-02AB004		R3
- KAMINISTIQUIA RIVER NEAR DORA	-02AB001		R3
- KAPUSKASING RIVER AT KAPUSKASING	-04LF001		R2
- KASHABOWIE R. AT OUTLET OF KASHABOWIE L	-02AB013		R3
- KAWINOGAMS RIVER NEAR PICKLE CROW	-04FA002		R2
- KEMPTVILLE CREEK NEAR KEMPTVILLE	-02LA006		R1
- KENNY CREEK NEAR BURFORD	-02GB009		N
- KENOGAMI R. AT KENOGAMI DAM (1939-64)	-04JD002		L R4
- KENOGAMI R. AT KENOGAMI DAM (1966-80)	-04JD002		L R4
- KENOGAMI RIVER NEAR MANNAMATTAWA	-04JC001		R4
- KETTLE CREEK AT ST. THOMAS	-02GC002		R2
- KWATABOAHEGAN RIVER NEAR THE MOUTH	-04KA001		H L N
- LA VALLEE RIVER NEAR DEVLIN	-05PC016		N
- LA VASE RIVER AT NORTH BAY	-02DD013		F HLN
- LADY EVELYN RIVER AT LADY EVELYN LAKE	-02JD011		R3
- LAKE 239 LOWER EAST INLET NEAR KENORA	-05PD024		< N
- LAKE 239 UPPER EAST INLET NEAR KENORA	-05PD025		< N
- LAUREL CREEK AT WATERLOO	-02GA024		R3
- LITTER CASTOR RIVER NEAR EMBRUN	-02LB016		< N
- LITTLE CURRENT RIVER AT PERCY LAKE	-04JF001		N
- LITTLE DON RIVER AT DON HILLS	-02HC029		D N
- LITTLE DON RIVER AT DON HILLS/LANSING	-02HC029		N
- LITTLE DON RIVER NEAR LANSING	-02HC004		F N
- LITTLE MAITLAND RIVER AT BLUEVALE	-02FE007		R2
- LITTLE OTTER CREEK NEAR STRAFFORDVILLE	-02GC015		R1
- LITTLE PIC RIVER NEAR COLDWELL	-02BA003		N
- LITTLE ROUGE CREEK NEAR LOCUST HILL	-02HC028		L N
- LITTLE WHITE RIVER NEAR BELLINGHAM	-02CC005		D R3
- LUTTERAL CREEK NEAR OUSTIC	-02GA033		L R2
- LYN CREEK NEAR LYN	-02MB006		U R4
- LYNDE CREEK NEAR WHITBY	-02HC018		D N
- LYNDHURST CREEK AT LYNDHURST	-02MA001		< U R
- LYNN RIVER AT SINCOE	-02GC008		R2
- MACKIE CREEK NEAR STEPHENS GULCH	-02MD222		F N
- MAD RIVER NEAR GLENCAIRN	-02ED005		R1
- MADAWASKA RIVER AT WHITNEY	-02KD006		L R2
- MADAWASKA RIVER AT BARK LAKE DAM	-02KD007		R2
- MADAWASKA RIVER AT CALABOGIE	-02KE003		R2
- MADAWASKA RIVER AT MADAWASKA	-02KD001		L R2
- MADAWASKA RIVER AT PALMER RAPIDS	-02KD004		R2
- MADAWASKA RIVER AT STEWARTVILLE	-02KE005		D R2
- MADAWASKA RIVER NEAR ARNPRIOR	-02KE002		R2
- MAGNETAWAN RIVER AT MAPLE ISLAND	-02EA008		F L R
- MAGNETAWAN RIVER NEAR BRITT	-02EA011		F R
- MAGNETAWAN RIVER NEAR BURK'S FALLS	-02EA006		R
- MAGPIE RIVER AT STEEP HILL FALLS	-02BD001		R

TABLE 4.1.0

SHEET 6 OF 12

LIST OF STATIONS AND NOTES ON DATA USED FOR STUDY

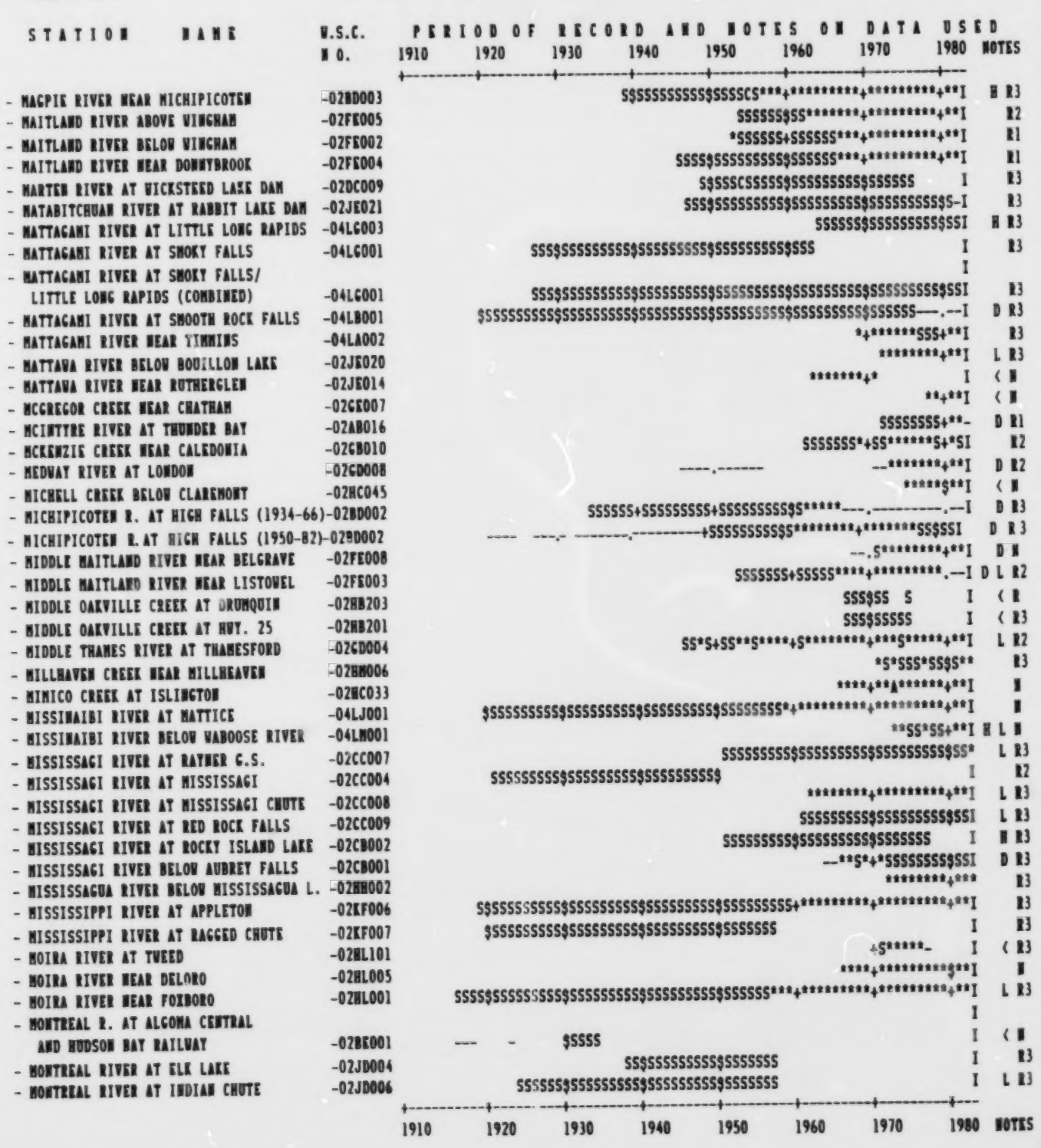

STATION NAME
W.S.C. NO.
PERIOD OF RECORD AND NOTES ON DATA USED
1910
1920
1930
1940
1950
1960
1970
1980
NOTES
- MAGPIE RIVER NEAR MICHIPICOTEN -02BD003 H R3
- MAITLAND RIVER ABOVE WINGHAM -02FE005 R2
- MAITLAND RIVER BELOW WINGHAM -02FE002 R1
- MAITLAND RIVER NEAR DONNYBROOK -02FE004 R1
- MARTEN RIVER AT WICKSTEED LAKE DAM -02DC009 R3
- MATABITCHUAN RIVER AT RABBIT LAKE DAM -02JE021 R3
- MATTAGAMI RIVER AT LITTLE LONG RAPIDS -04LG003 H R3
- MATTAGAMI RIVER AT SMOKY FALLS -04LG001 R3
- MATTAGAMI RIVER AT SMOKY FALLS/ LITTLE LONG RAPIDS (COMBINED) -04LG001 R3
- MATTAGAMI RIVER AT SMOOTH ROCK FALLS -04LB001 D R3
- MATTAGAMI RIVER NEAR TIMMINS -04LA002 R3
- MATTAWA RIVER BELOW BOUILLON LAKE -02JE020 L R3
- MATTAWA RIVER NEAR RUTHERGLEN -02JE014 < H
- MCGREGOR CREEK NEAR CHATHAM -02GE007 < H
- MCINTYRE RIVER AT THUNDER BAY -02AB016 D R1
- MCKENZIE CREEK NEAR CALEDONIA -02GB010 R2
- MEDWAY RIVER AT LONDON -02GD008 D R2
- MICHELL CREEK BELOW CLAREMONT -02HC045 < H
- MICHIPICOTEN R. AT HIGH FALLS (1934-66) -02BD002 D R3
- MICHIPICOTEN R.AT HIGH FALLS (1950-82) -02BD002 D R3
- MIDDLE MAITLAND RIVER NEAR BELGRAVE -02FE008 D H
- MIDDLE MAITLAND RIVER NEAR LISTOWEL -02FE003 D L R2
- MIDDLE OAKVILLE CREEK AT DRUMQUIN -02HB203 < R
- MIDDLE OAKVILLE CREEK AT HWY. 25 -02HB201 < R3
- MIDDLE THAMES RIVER AT THAMESFORD -02GD004 L R2
- MILLHAVEN CREEK NEAR MILLHEAVEN -02HH006 R3
- MIMICO CREEK AT ISLINGTON -02HC033 H
- MISSINAIBI RIVER AT MATTICE -04LJ001 H
- MISSINAIBI RIVER BELOW WABOOSE RIVER -04LM001 H L H
- MISSISSAGI RIVER AT RATHER G.S. -02CC007 L R3
- MISSISSAGI RIVER AT MISSISSAGI -02CC004 R2
- MISSISSAGI RIVER AT MISSISSAGI CHUTE -02CC008 L R3
- MISSISSAGI RIVER AT RED ROCK FALLS -02CC009 L R3
- MISSISSAGI RIVER AT ROCKY ISLAND LAKE -02CB002 H R3
- MISSISSAGI RIVER BELOW AUBREY FALLS -02CB001 D R3
- MISSISSAGUA RIVER BELOW MISSISSAGUA L. -02HH002 R3
- MISSISSIPPI RIVER AT APPLETON -02KF006 R3
- MISSISSIPPI RIVER AT RAGGED CHUTE -02KF007 R3
- MOIRA RIVER AT TWEED -02HL101 < R3
- MOIRA RIVER NEAR DELORO -02HL005 H
- MOIRA RIVER NEAR FOXBORO -02HL001 L R3
- MONTREAL R. AT ALGOMA CENTRAL AND HUDSON BAY RAILWAY -02BE001 < H
- MONTREAL RIVER AT ELK LAKE -02JD004 R3
- MONTREAL RIVER AT INDIAN CHUTE -02JD006 L R3

TABLE 4.1.0

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LIST OF STATIONS AND NOTES ON DATA USED FOR STUDY

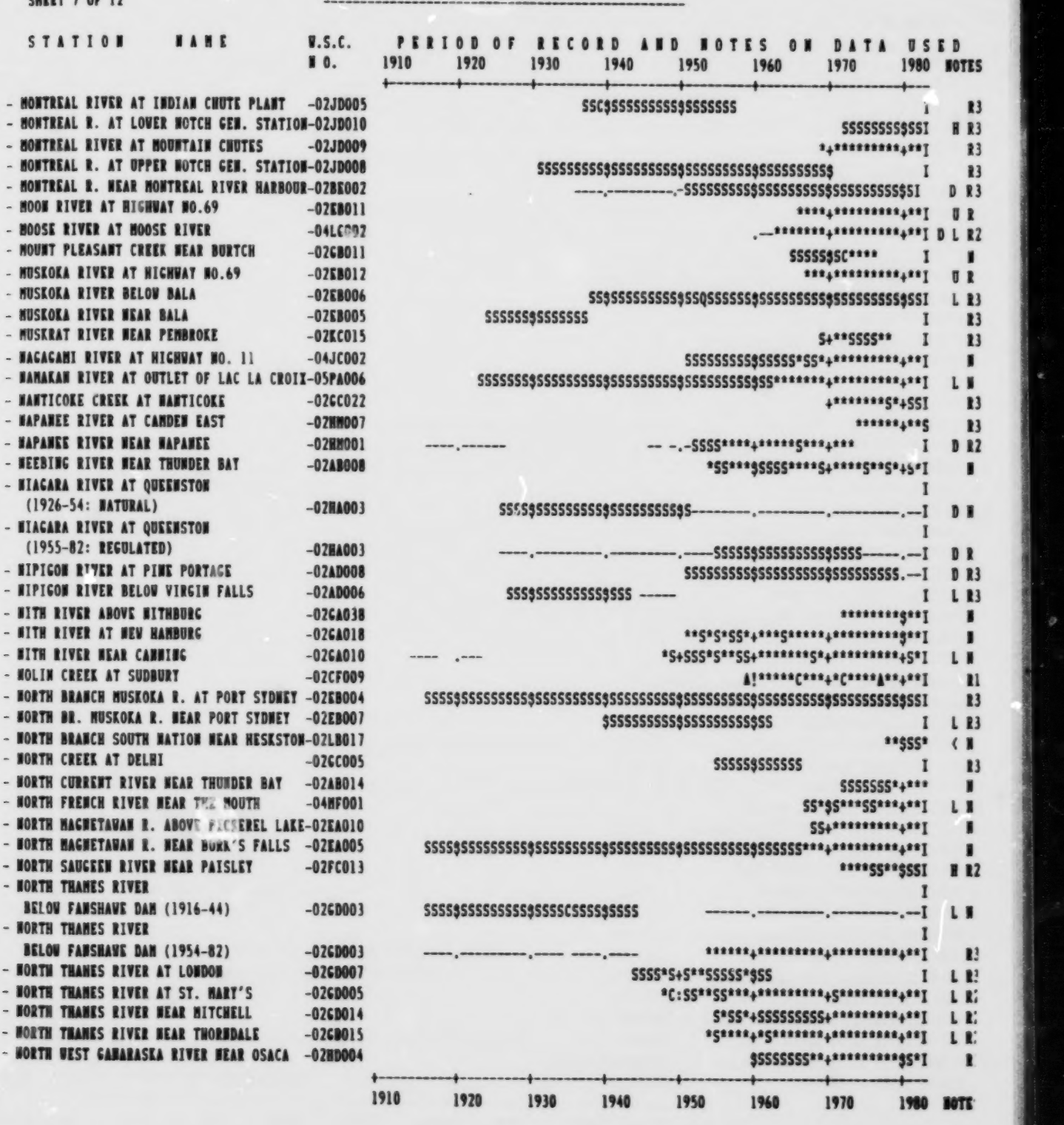
STATION NAME
W.S.C. NO.
PERIOD OF RECORD AND NOTES ON DATA USED
1910
1920
1930
1940
1950
1960
1970
1980
NOTES
- MONTREAL RIVER AT INDIAN CHUTE PLANT -02JD005 R3
- MONTREAL R. AT LOWER NOTCH GEN. STATION-02JD010 H R3
- MONTREAL RIVER AT MOUNTAIN CHUTES -02JD009 R3
- MONTREAL R. AT UPPER NOTCH GEN. STATION-02JD008 R3
- MONTREAL R. NEAR MONTREAL RIVER HARBOUR-02BE002 D R3
- MOON RIVER AT HIGHWAY NO.69 -02EB011 U R
- MOOSE RIVER AT MOOSE RIVER -04LC002 D L R2
- MOUNT PLEASANT CREEK NEAR BURTCH -02GB011 N
- MUSKOKA RIVER AT HIGHWAY NO.69 -02EB012 U R
- MUSKOKA RIVER BELOW BALA -02EB006 L R3
- MUSKOKA RIVER NEAR BALA -02EB005 R3
- MUSKRAT RIVER NEAR PEMBROKE -02KC015 R3
- NAGAGAMI RIVER AT HIGHWAY NO. 11 -04JC002 N
- NAMAKAN RIVER AT OUTLET OF LAC LA CROIX-05PA006 L N
- NANTICOKE CREEK AT NANTICOKE -02GC022 R3
- NAPANEE RIVER AT CAMDEN EAST -02HM007 R3
- NAPANEE RIVER NEAR NAPANEE -02HM001 D R2
- NEEBING RIVER NEAR THUNDER BAY -02AB008 N
- NIAGARA RIVER AT QUEENSTON (1926-54: NATURAL) -02HA003 D N
- NIAGARA RIVER AT QUEENSTON (1955-82: REGULATED) -02HA003 D R
- NIPIGON RIVER AT PINE PORTAGE -02AD008 D R3
- NIPIGON RIVER BELOW VIRGIN FALLS -02AD006 L R3
- NITH RIVER ABOVE NITHBURG -02GA038 N
- NITH RIVER AT NEW HAMBURG -02GA018 N
- NITH RIVER NEAR CANNING -02GA010 L N
- NOLIN CREEK AT SUDBURY -02CF009 R1
- NORTH BRANCH MUSKOKA R. AT PORT SYDNEY -02EB004 R3
- NORTH BR. MUSKOKA R. NEAR PORT SYDNEY -02EB007 L R3
- NORTH BRANCH SOUTH NATION NEAR HESKSTON-02LB017 (N
- NORTH CREEK AT DELHI -02GC005 R3
- NORTH CURRENT RIVER NEAR THUNDER BAY -02AB014 N
- NORTH FRENCH RIVER NEAR TIE MOUTH -04HF001 L N
- NORTH MAGNETAWAN R. ABOVE PICKEREL LAKE-02EA010 N
- NORTH MAGNETAWAN R. NEAR BURK'S FALLS -02EA005 N
- NORTH SAUGEEN RIVER NEAR PAISLEY -02FC013 H R2
- NORTH THAMES RIVER BELOW FANSHAWE DAM (1916-44) -02GD003 L N
- NORTH THAMES RIVER BELOW FANSHAWE DAM (1954-82) -02GD003 R2
- NORTH THAMES RIVER AT LONDON -02GD007 L R2
- NORTH THAMES RIVER AT ST. MARY'S -02GD005 L R2
- NORTH THAMES RIVER NEAR MITCHELL -02GD014 L R2
- NORTH THAMES RIVER NEAR THORNDALE -02GB015 L R2
- NORTH WEST GAMARASKA RIVER NEAR OSACA -02HD004 R

TABLE 4.1.0

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LIST OF STATIONS AND NOTES ON DATA USED FOR STUDY

STATION NAME	U.S.C. NO.	PERIOD OF RECORD AND NOTES ON DATA USED	NOTES
		1910 1920 1930 1940 1950 1960 1970 1980	
- NORTHWEST TRIB. TO L. 239 NEAR KENORA	-05PD022		H
- NOTTAWASAGA RIVER NEAR ALLISTON	-02ED101		F H
- NOTTAWASAGA RIVER NEAR BAXTER	-02ED003		H H
- O.A.C. FARM GAUGE NO. 5 AT GUELPH	-02GA032		D H
- OAKVILLE CREEK AT MILTON	-02HB005		H R3
- OGOKI RIVER ABOVE WHITECLAY LAKE	-04GB004		H H
- OHAPING RIVER NEAR LEVACK	-02CF010		(H
- ORONO CREEK NEAR ORONO	-02HD234		(H
- OSHAWA CREEK AT OSHAWA	-02HD008		L H
- OTONABEE RIVER AT LAKEFIELD	-02HJ002		R3
- OTOSKWIN RIVER BELOW BADESDAWA LAKE	-04FA001		D R1
- OTTAWA RIVER AT DES JOACHIMS	-02KA002		H R3
- OTTAWA RIVER AT LA CAVE RAPIDS	-02JE012		R3
- OUSE RIVER NEAR WESTWOOD	-02HJ003		D R1
- OTTAWA RIVER NEAR TIMISKAMING	-02JE003		R3
- PAGWACHUAN RIVER AT HIGHWAY NO. 11	-04JD005		H
- PARKHILL CREEK ABOVE PARKHILL RESERVOIR	-02FF008		H
- PARKHILL CREEK NEAR PARKHILL	-02FF003		H
- PARES CREEK NEAR LATTA	-02HL103		(H
- PASHKOKAGAN R. AT OUTLET PASHKOKAGAN L.	-04GA003		(H
- PATTERSON CREEK NEAR SIMCOE	-02GC012		R1
- PAYNE RIVER NEAR BERWICK	-02LB022		(H
- PEFFERLAW BROOK NEAR UDORA	-02EC103		H
- PERCH LAKE INLET NO. 1 NEAR CHALK RIVER	-02KA004		D H H
- PERCH LAKE INLET NO. 2 NEAR CHALK RIVER	-02KA005		D H
- PERCH LAKE INLET NO. 3 NEAR CHALK RIVER	-02KA006		D H
- PERCH LAKE INLET NO. 4 NEAR CHALK RIVER	-02KA007		D H
- PERCH LAKE INLET NO. 5 NEAR CHALK RIVER	-02KA008		F H
- PERCH LAKE OUTLET NEAR CHALK RIVER	-02KA003		H
- PETAWAWA RIVER NEAR PETAWAWA	-02KB001		L R3
- PIC RIVER NEAR MARATHON	-02BB003		L H
- PIGEON RIVER AT MIDDLE FALLS	-02AA001		H
- PINE RIVER AT LURGAN	-02FD001		H L H
- PINE RIVER NEAR CROOKS	-02AA002		(H
- PINE RIVER NEAR EVERETT	-02ED103		H
- PINEIMUTA RIVER AT EYES LAKE	-04FA003		H
- PINEWOOD RIVER NEAR PINEWOOD	-05PC011		H
- PIPESTONE RIVER AT KARL LAKE	-04DA001		D H
- PORCUPINE RIVER AT HOYLE	-04MD004		(H
- RAINY RIVER AT FORT FRANCES	-05PC019		D R3
- RAINY RIVER AT MANITOU RAPIDS	-05PC018		R3
- RAISIN RIVER NEAR WILLIAMSTOWN	-02MC001		L H
- REDHILL CREEK AT HAMILTON	-02HA014		(H
- REESOR CREEK ABOVE GREEN RIVER	-02MC039		(R
- RIDEAU RIVER ABOVE SMITHS FALLS	-02LA005		D R3
- RIDEAU RIVER AT OTTAWA	-02LA004		L R3
		1910 1920 1930 1940 1950 1960 1970 1980	NOTES

TABLE 4.1.0

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LIST OF STATIONS AND NOTES ON DATA USED FOR STUDY

STATION NAME	W.S.C. NO.	PERIOD OF RECORD AND NOTES ON DATA USED 1910 1920 1930 1940 1950 1960 1970 1980	NOTES
- ROCHESTER CREEK ABOVE QUIRKE LAKE	-02CD005		< R
- ROCKY SAUGEEN RIVER NEAR TRAVERSTON	-02FC004		I L H N
- ROOT RIVER AT SAULT STE. MARIE	-02CA002		N
- ROSEBERRY RIVER ABOVE ROSEBERRY LAKES	-04CA003		I L D N
- ROUGE RIVER AT ROUGE HILL	-02HC015		< R
- ROUGE RIVER NEAR MARKHAM	-02HC022		I D L R3
- RUSCON RIVER NEAR RUSCON STATION	-02GH002		N
- ST. LAWERENCE RIVER AT CORNWALL	-02MC002		I D R
- ST. LAWERENCE RIVER AT IROQUOIS	-02MB005		I D R
- SACHIGO RIVER BELOW BEAVESTONE RIVER	-04CD001		N
- SACHIGO R. BELOW OUTLET OF SACHIGO LAKE	-04CD002		I D N
- SALMON RIVER NEAR SHANNONVILLE	-02HN003		R2
- SAUBLE RIVER AT SAUBLE FALLS	-02FA001		N
- SAUGEEN RIVER ABOVE DURHAM	-02FC016		< N
- SAUGEEN RIVER NEAR DURHAM	-02FC014		< R
- SAUGEEN RIVER NEAR PORT ELGIN	-02FC001		N
- SAUGEEN RIVER NEAR WALKERTON	-02FC002		N
- SCHNEIDER CREEK AT KITCHENER	-02GA037		N
- SCHOMBERG RIVER NEAR SCHOMBERG	-02EC010		N
- SEINE R. AT STURGEON FALLS GEN. STATION	-05PB009		R3
- SERPENT RIVER ABOVE QUIRKE LAKE	-02CD006		< N
- SERPENT RIVER AT HIGHWAY NO.17	-02CD001		N
- SERPENT RIVER AT OUTLET OF DUNLOP LAKE	-02CD002		< R3
- SERPENT RIVER BELOW PECORS LAKE	-02CD004		< R
- SERPENT RIVER BELOW QUIRKE LAKE	-02CD003		< R
- SEVERN RIVER AT LIMESTONE RAPIDS	-04CC001		F N
- SEVERN R. AT OUTLET OF MUSKRAT DAM LAKE	-04CA002		F N
- SEVERN RIVER AT SWIFT RAPID	-02EC003		D R3
- SEVERN RIVER BELOW OUTLET OF DEER LAKE	-04CA004		D N
- SEVERN RIVER BELOW WASHAGO	-02EC004		L R3
- SHAMATTAWA R. AT OUTLET OF SHAMATTAWA L	-04DC002		N
- SHAWANAGA RIVER AT HIGHWAY NO. 69	-02EA012		< N
- SHEBANDOWAN RIVER AT GLENWATER	-02AB005		R3
- SHEBANDOWAN RIVER AT SUNSHINE	-02AB009		L R3
- SHEKAK RIVER AT HIGHWAY NO.11	-04JC003		N
- SHELTER VALLEY BROOK NEAR GRAFTON	-02HD010		H N
- SHIPKA CREEK NEAR GRAND BEND	-02FF006		N
- SILVER CREEK NEAR COPENHAGEN	-02GC024		< R
- SKOOTAMATTA RIVER NEAR ACTINOLITE	-02HL004		D N
- SOPER CREEK AT BOWMANVILLE	-02HD007		H N
- SOPER CREEK NEAR STEPHENS GULCH	-02HD223		I H L N
- SOPER CREEK NEAR TYRONE	-02HD221		N
- SOPER CREEK TRIB. NEAR BOWMANVILLE	-02HD224		I DHL N
- SOUTH BRANCH MUSKOKA R. AT BAYSVILLE	-02EB008		L R
- SOUTH BRANCH MUSKOKA R. AT BLACK BRIDGE	-02EB002		I L R
- SOUTH BRANCH MUSKOKA RIVER AT MATHIAS	-02EB003		I L R
		1910 1920 1930 1940 1950 1960 1970 1980	NOTE

TABLE 4.1.0

SHEET 10 OF 12

LIST OF STATIONS AND NOTES ON DATA USED FOR STUDY

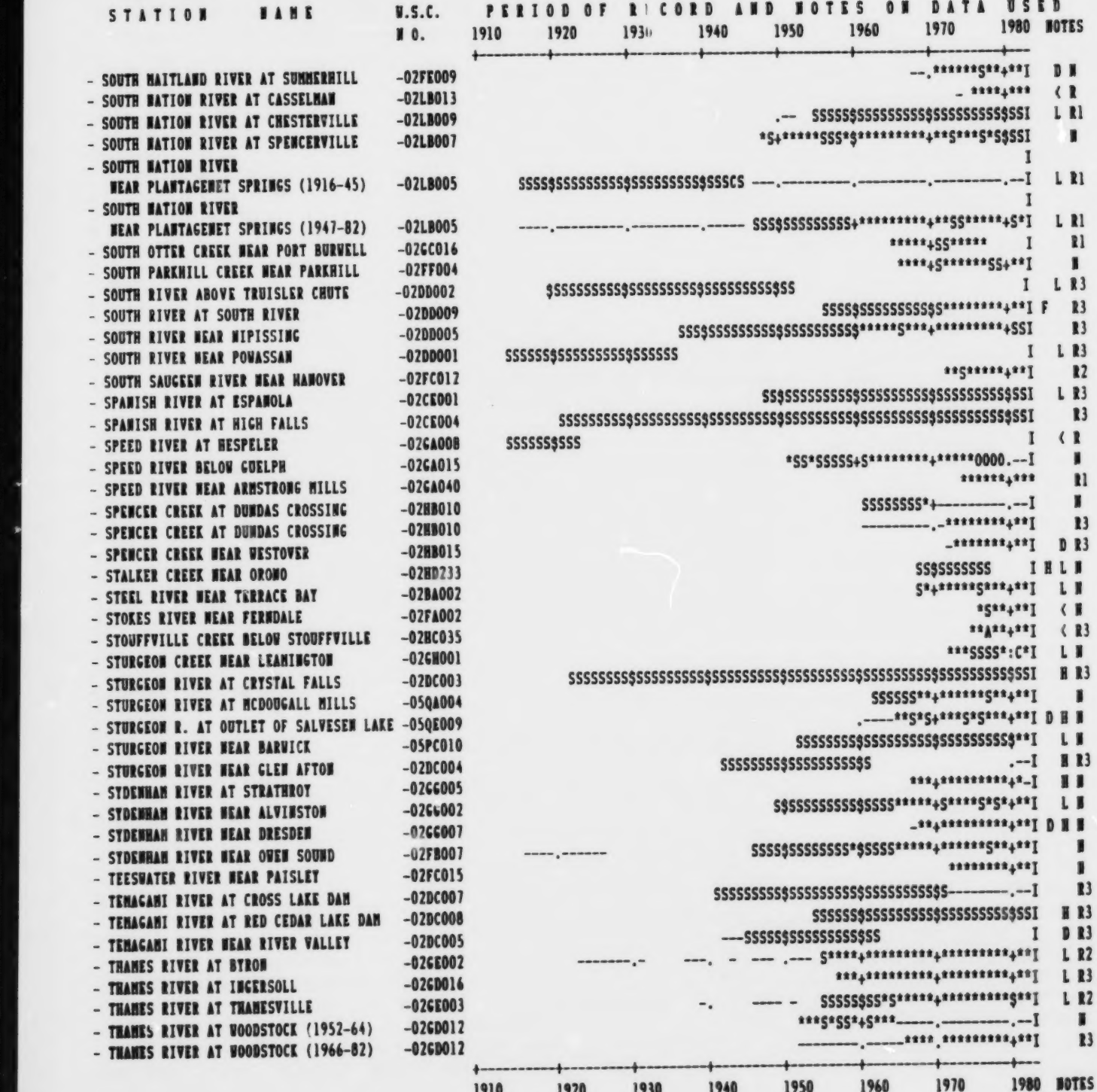
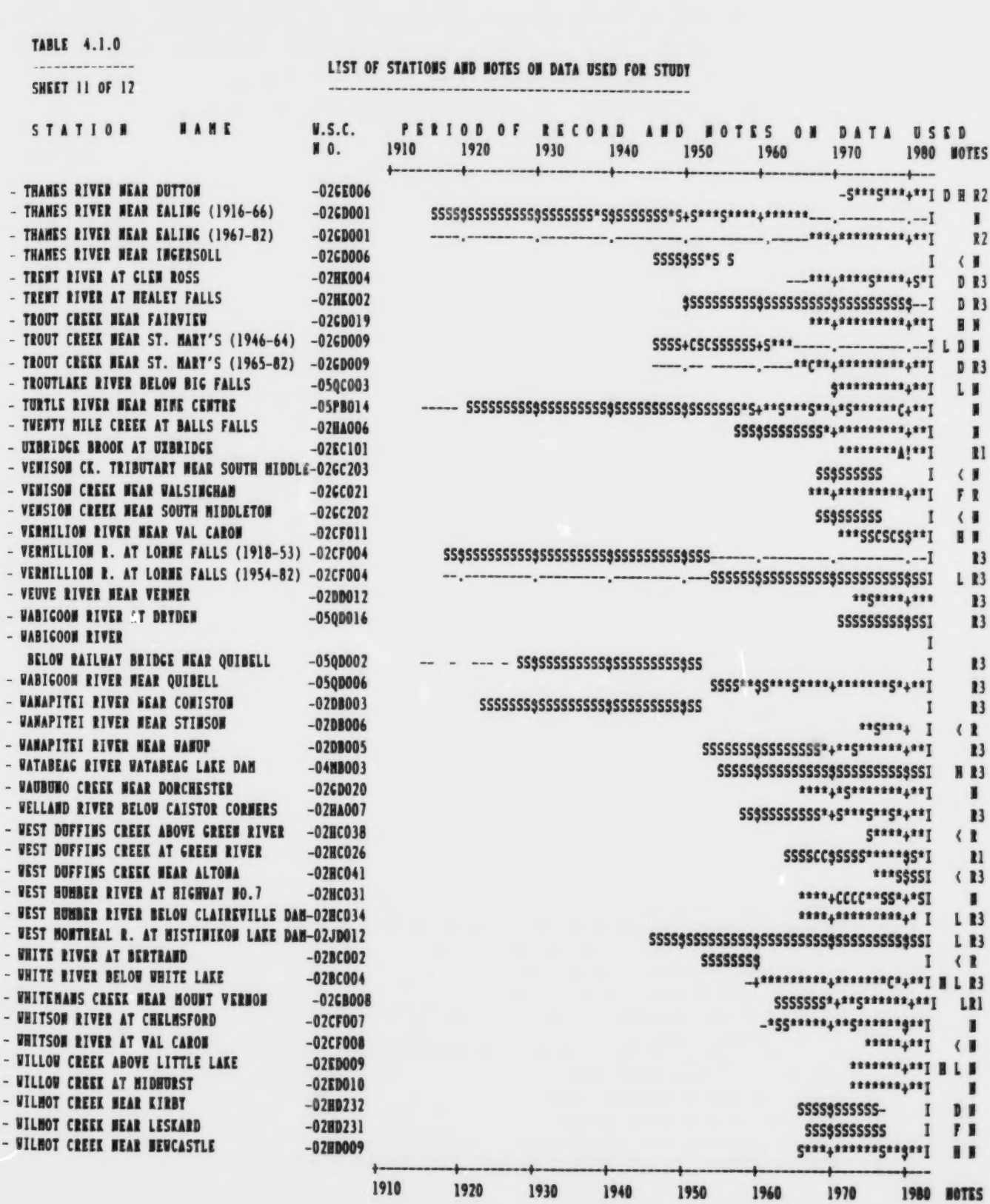

STATION NAME
W.S.C. NO.
PERIOD OF RECORD AND NOTES ON DATA USED
1910
1920
1930
1940
1950
1960
1970
1980
NOTES
- SOUTH MAITLAND RIVER AT SUMMERHILL -02FE009
- SOUTH NATION RIVER AT CASSELMAN -02LB013
- SOUTH NATION RIVER AT CHESTERVILLE -02LB009
- SOUTH NATION RIVER AT SPENCERVILLE -02LB007
- SOUTH NATION RIVER NEAR PLANTAGENET SPRINGS (1916-45) -02LB005
- SOUTH NATION RIVER NEAR PLANTAGENET SPRINGS (1947-82) -02LB005
- SOUTH OTTER CREEK NEAR PORT BURWELL -02GC016
- SOUTH PARKHILL CREEK NEAR PARKHILL -02FF004
- SOUTH RIVER ABOVE TRUISLER CHUTE -02DD002
- SOUTH RIVER AT SOUTH RIVER -02DD009
- SOUTH RIVER NEAR NIPISSING -02DD005
- SOUTH RIVER NEAR POWASSAN -02DD001
- SOUTH SAUGEEN RIVER NEAR HANOVER -02FC012
- SPANISH RIVER AT ESPANOLA -02CE001
- SPANISH RIVER AT HIGH FALLS -02CE004
- SPEED RIVER AT HESPELER -02GA008
- SPEED RIVER BELOW GUELPH -02GA015
- SPEED RIVER NEAR ARMSTRONG MILLS -02GA040
- SPENCER CREEK AT DUNDAS CROSSING -02HB010
- SPENCER CREEK AT DUNDAS CROSSING -02HB010
- SPENCER CREEK NEAR WESTOVER -02HB015
- STALKER CREEK NEAR ORONO -02HD233
- STEEL RIVER NEAR TERRACE BAY -02BA002
- STOKES RIVER NEAR FERNDALE -02FA002
- STOUFFVILLE CREEK BELOW STOUFFVILLE -02HC035
- STURGEON CREEK NEAR LEAMINGTON -02GH001
- STURGEON RIVER AT CRYSTAL FALLS -02DC003
- STURGEON RIVER AT MCDOUGALL MILLS -05QA004
- STURGEON R. AT OUTLET OF SALVESEN LAKE -05QE009
- STURGEON RIVER NEAR BARWICK -05PC010
- STURGEON RIVER NEAR GLEN AFTON -02DC004
- SYDENHAM RIVER AT STRATHROY -02GG005
- SYDENHAM RIVER NEAR ALVINSTON -02GG002
- SYDENHAM RIVER NEAR DRESDEN -02GG007
- SYDENHAM RIVER NEAR OWEN SOUND -02FB007
- TEESWATER RIVER NEAR PAISLEY -02FC015
- TEMAGAMI RIVER AT CROSS LAKE DAM -02DC007
- TEMAGAMI RIVER AT RED CEDAR LAKE DAM -02DC008
- TEMAGAMI RIVER NEAR RIVER VALLEY -02DC005
- THAMES RIVER AT BYRON -02GE002
- THAMES RIVER AT INGERSOLL -02GD016
- THAMES RIVER AT THAMESVILLE -02GE003
- THAMES RIVER AT WOODSTOCK (1952-64) -02GD012
- THAMES RIVER AT WOODSTOCK (1966-82) -02GD012

TABLE 4.1.0

SHEET 11 OF 12

LIST OF STATIONS AND NOTES ON DATA USED FOR STUDY



STATION NAME	W.S.C. NO.	PERIOD OF RECORD AND NOTES ON DATA USED (1910 1920 1930 1940 1950 1960 1970 1980)	NOTES
- THAMES RIVER NEAR DUTTON	-02GE006		
- THAMES RIVER NEAR EALING (1916-66)	-02GD001		
- THAMES RIVER NEAR EALING (1967-82)	-02GD001		
- THAMES RIVER NEAR INGERSOLL	-02GD006		
- TRENT RIVER AT GLEN ROSS	-02HK004		
- TRENT RIVER AT HEALEY FALLS	-02HK002		
- TROUT CREEK NEAR FAIRVIEW	-02GD019		
- TROUT CREEK NEAR ST. MARY'S (1946-64)	-02GD009		
- TROUT CREEK NEAR ST. MARY'S (1965-82)	-02GD009		
- TROUTLAKE RIVER BELOW BIG FALLS	-05QC003		
- TURTLE RIVER NEAR MINE CENTRE	-05PB014		
- TWENTY MILE CREEK AT BALLS FALLS	-02HA006		
- UXBRIDGE BROOK AT UXBRIDGE	-02EC101		
- VENISON CK. TRIBUTARY NEAR SOUTH MIDDLE	-02GC203		
- VENISON CREEK NEAR WALSINGHAM	-02GC021		
- VENSION CREEK NEAR SOUTH MIDDLETON	-02GC202		
- VERMILION RIVER NEAR VAL CARON	-02CF011		
- VERMILLION R. AT LORNE FALLS (1918-53)	-02CF004		
- VERMILLION R. AT LORNE FALLS (1954-82)	-02CF004		
- VEUVE RIVER NEAR VERNER	-02DD012		
- WABIGOON RIVER AT DRYDEN	-05QD016		
- WABIGOON RIVER BELOW RAILWAY BRIDGE NEAR QUIBELL	-05QD002		
- WABIGOON RIVER NEAR QUIBELL	-05QD006		
- WANAPITEI RIVER NEAR CONISTON	-02DB003		
- WANAPITEI RIVER NEAR STINSON	-02DB006		
- WANAPITEI RIVER NEAR WANUP	-02DB005		
- WATABEAG RIVER WATABEAG LAKE DAM	-04MB003		
- WAUBUNO CREEK NEAR DORCHESTER	-02GD020		
- WELLAND RIVER BELOW CAISTOR CORNERS	-02HA007		
- WEST DUFFINS CREEK ABOVE GREEN RIVER	-02HC038		
- WEST DUFFINS CREEK AT GREEN RIVER	-02HC026		
- WEST DUFFINS CREEK NEAR ALTONA	-02HC041		
- WEST HUMBER RIVER AT HIGHWAY NO.7	-02HC031		
- WEST HUMBER RIVER BELOW CLAIREVILLE DAM	-02HC034		
- WEST MONTREAL R. AT MISTINIKON LAKE DAM	-02JD012		
- WHITE RIVER AT BERTRAND	-02BC002		
- WHITE RIVER BELOW WHITE LAKE	-02BC004		
- WHITEMANS CREEK NEAR MOUNT VERNON	-02GB008		
- WHITSON RIVER AT CHELMSFORD	-02CF007		
- WHITSON RIVER AT VAL CARON	-02CF008		
- WILLOW CREEK ABOVE LITTLE LAKE	-02ED009		
- WILLOW CREEK AT MIDHURST	-02ED010		
- WILMOT CREEK NEAR KIRBY	-02HD232		
- WILMOT CREEK NEAR LESKARD	-02HD231		
- WILMOT CREEK NEAR NEWCASTLE	-02HD009		

TABLE 4.1.0

SHEET 12 OF 12

LIST OF STATIONS AND NOTES ON DATA USED FOR STUDY

STATION NAME	W.S.C. NO.	PERIOD OF RECORD AND NOTES ON DATA USED								NOTES
		1910	1920	1930	1940	1950	1960	1970	1980	
- WILTON CREEK AT HARROWSMITH	-02HM201							S$SSSSS	I	< N
- WILTON CREEK NEAR NAPANEE	-02HM004							- ---.-***SSSSS$S*I		D H N
- WINDIGO RIVER ABOVE MUSKRAT DAM LAKE	-04CB001							**+*****S***+--I		D L N
- WINISK RIVER AT KANUCHUAN RAPIDS	-04DA002							SS+*******	I	N
- WINISK R. BELOW ASHEWEIG R. TRIBUTARY	-04DC001							*SS*$SSSC*SSS*$S	I	L N
- WIXON CREEK BELOW ALTONA	-02HC046							S*****+***I		< N
- WOLF RIVER AT HIGHWAY NO.17	-02AC001							*********+***I		F N
- WYE CREEK NEAR THORNDALE	-02GD013					—		******+****		F N
- WYE RIVER AT WYEBRIDGE	-02ED011							******+***I		< N
- YORK RIVER NEAR BANCROFT	-02KD002	----.---------.			.SSSSSSSSS$SSSSSSSSS$SSSSSS***+*********+***I					D R3
- YOUNG CREEK NEAR VITTORIA	-02GC014						---**S+*********+***I			D R2
		1910	1920	1930	1940	1950	1960	1970	1980	NOTES

LEGEND TO DATA SYMBOLS

+/* MAXIMUM INSTANTANEOUS DISCHARGE DATA (MID)
$/S SYNTHESIZED' MID '(USING "SANGAL'S METHOD")
:/C DISCHARGE DATA ESTIMATED BY CORRELATION
!/A AVERAGE RATIO (MID/MD) USED TO SYNTHESIZE 'MID'
./- DATA NOT USED IN 'FFA'
%/O REGULATED DATA "NATURALIZED" (BY OTHERS)
I TERMINATOR (LOCATED AT DATA YEAR=1983)

LEGEND TO NOTES ON DATA

< ONLY 5-9 YEARS OF USABLE DATA WAS AVAILLABLE FOR STATION
D DATA HAD TO BE REMOVED FOR STATION TO PASS ALL "NONPARA" TESTS
F DATA COULD NOT BE MANIPULATED TO PASS ALL "NONPARA" TESTS
H HIGH OUTLIERS WERE DETECTED IN THE DATA SAMPLE
L LOW OUTLIERS WERE DETECTED IN THE DATA SAMPLE
M MAXIMUM FOR PERIOD OF RECORD WAS INCLUDED IN FFA USING PROGRAM "ISTORIC"
N NATURAL DISCHARGES AT STATION
R REGULATED DISCHARGES AT STATION (NO CLASSIFICATION RATING ASSIGNED)
R1 MINOR REGULATION EFFECTS ON DISCHARGES
R2 MODERATE REGULATION EFFECTS ON DISCHARGES
R3 MAJOR REGULATION EFFECTS ON DISCHARGES
R4 DISCHARGES AFFECTED BY MAJOR WATER DIVERSIONS
U UNCERTAIN WATERSHED AREA CONTRIBUTING TO DISCHARGE (FLOW UPSTREAM DIVIDES)

The Hudson Bay Lowland is a large area of low relief and poor drainage. Bogs abound throughout the area. These features result in retention of water in the drainage basins with a relatively slow and modest response to rainfall and snowmelt.

The Canadian Shield areas typically have a thin cover of soil over the rock. Relief is much greater than in the other regions, resulting in a greater and more rapid runoff than in other areas. This is moderated to some extent by the ambundance of small lakes in the area which provide some storage of runoff.

The Great Lakes-St. Lawrence Lowland has a deep overburden of soil. The relief is generally moderate and the soil is well drained. Lakes are uncommon but marshes do provide some storage of runoff although many of the marshes have been drained for agricultural use. The Niagara Escarpment bisects this region and influences both the local climate and runoff.

A number of watershed characteristics influence the flood response of drainage basins. These characteristics include drainage area size, land use, water storage, watershed slope, stream density, overburden, watershed shape, channel length, and basin location. These characteristics vary markedly throughout the physiographic regions of Ontario.

4.1.3 Data Synthesis

4.1.3.1 Estimation of Maximum Instantaneous Flow Data from Maximum Mean Flow Data

The need to estimate the annual maximum instantaneous flow (MID) from the annual maximum daily mean flow (MD) was previously discussed and the techniques adopted in the study to accomplish this is explained below.

Various methods have been utilized in the past to provide an estimate of peak flows. The following are the most commonly used methods:

(1) Fullers Method - This method is based on a plot of (MID/MD-1) versus the drainage area (A) for 24 river basins located in the Eastern United States. From this plot on log-log paper, an "average" curve was drawn giving the relationship:

$$Q = MD(1+1.5A^{-0.3})$$

Where: Q = Predicted peak flow

A = Drainage area (Sq. Km.)

(2) Langbein's Method - This method uses charts (given in Applied Hydrology by Lindsey et al. (1949) based on observed data of MID's and corresponding MD's. The QD's for three consecutive days, with the MD value on the second day, along with the time of peak are required. The ratio of MID to MD and the time of peak are shown as functions of MD/QD (day 1) and MD/QD (day3).

(3) By using regression analysis of MID versus MD to derive a relationship for each station where both series are available over the same period.

The above methods (1) and (2) may be used to apply an average ratio to the QD data series before frequency analysis, or may be applied to the various return period flows generated from QD data series. Method (3) was limited to data where both series were available to convert the early part of the manual recorded QD data base to peak data.

Another method in recent use involves carrying out separate frequency analyses on MID and MD data for the overlapping period of record and obtaining a ratio of MID/MD for each return period flow. These ratios are then applied to the MD frequency curve derived for the entire QD series. Multiple Regression Analysis of these ratios against basin hydrometeorologic and location parameters is then undertaken to derive expressions to estimate MID for stations having only MD data.

The method adopted for this study was based on a method developed at the National Hydrology Research Institute, Environment Canada, by B.P. Sangal (1981). From the report abstract, "The method uses variables that are the mean daily flows of three consecutive days, with the maximum mean daily flow occupying the middle position. A parameter, the value of which lies between zero and two, is designated as base factor K and has a governing influence on the estimated peak. The predicting formula employed assumes that the K value is equal to one. The method has been applied to streams in Ontario, involving a total of 387 stations equipped with recording gauges, the drainage area of which vary from less than 1 $km.^2$ to more than 100,000 km^2. The number of instantaneous peak data available was 3946 in the period of record ending in 1979. About 57% of the predicted peaks lie within 10% and about 79% within 20% of the actual value. About 62% of the peaks have been overpredicted. The parameter K must be estimated for rainfall floods occurring on small streams. Its value will generally be less than one for such cases. Some methods have been suggested for its estimation."

The relationship between the various parameters was derived from a geometric representation of the flow hydrograph, assuming a triangular hydrograph to represent the peak flow, superimposed over three rectangular hydrographs representing the mean flows for the three consecutive days chosen.

The general equation for the predicted instantaneous flood peak (QPP):

$$QPP = (QD1+QD3)/2 + (QD2-QD1-QD3)/(1-2\alpha) \qquad (1)$$

Where QD1, QD2, and QD3 represent the daily mean flows on days 1, 2 and 3 respectively; QD2 is the annual maximum daily mean flow (MD).

The term $(1-2\alpha)$ is defined as the base factor K.

When $\alpha = 0$ (or K=1) the equation (1) becomes the basic equation:

$$QPP = (4QD2-QD1-QD3)/2 \qquad (2)$$

The above equations were based on the premise that annual maximum mean flow occurs on the same or on the following day as the actual maximum peak flow. This was not always the case when comparing MID and MD data; however, when only QD data was available, this premise had to be assumed. It was found during this study that unrealistically high values of the ratio QPP/MD (=rc) sometimes resulted when the MID did not occur within a period of one day of the MD. In these cases, a test was devised to identify these overly high ratios. The maximum ratio of MID/MD (=rmx) for the overlapping series, if available, for each station was used as an upper limit beyond which all QPP values were set at rmx x MD. The mean value of MID/MD (=rm) and other sample statistics were also computed along with rmx. The mean value was used if QD1 or QD3 were missing from the daily mean flow series, in which case QPP = rm x MD. The sample statistics of the rc series were also computed and compared to the MID/QD (=r) series based on observed data if available.

Regression analyses were carried out between (rmx-1) and (rm-1) vs. drainage area for various sample groupings covering all of the province using a total of 354 stations. The rm and rmx data for these stations is shown on Tables A15.1 to A15.4. The equations for these groupings, giving the least standard error of estimate for remx (= estimate of rmx) and re (= estimate of rm), were chosen to help provide estimates for stations which did not have any MID data. The regression estimates were verified or adjusted after comparison was made with actual values derived from other stations on the same watershed or on similar watersheds nearby.

During the initial stages of the study, equation (2) was used but subsequently it proved more expedient to use equation (1) and estimate the base factor using the computed base factors and other data found in the publication by Sangal (1981). The mean values of K were used for this purpose. Closer agreement between the sample statistics of ratios r and rc was evident when equation (1) was used. Ultimately, it was found that an iterative process could be used to increment K to close the gap between the mean ratios of the actual/estimated series and the synthetic series. The resulting base factors were very close to expected values. The maximum percentage deviation of synthetized mean ratios from actual/estimated mean ratios were in the range -10% to +15%. The mean difference was approximately +2%, with a standard deviation of approximately 5% when considering stations having at least two data values synthetized. Table 4.1 shows all the stations selected for inclusion in the study according to the criteria discussed in Section 4.1.2. Some have been included for general information only and were not used in the regional analyses.

Synthetized data and other information was indicated by the notations shown in the legend at the end of the table.

In the foregoing, procedures to establish instantaneous peak flow rates from the maximum daily flow information were described. Before employing the synthesized data in the Single Station Frequency Analysis, it was necessary to ascertain that the procedure for conversion has not biased the flow series. Tests were devised for this purpose and are described in the following paragraphs.

Ten stations were selected, each having at least twenty-five years of instantaneous peak flow information. These stations ranged from 59.6 sq. km. to 8940 sq. km. in area and reflected a mixture of regulated and natural flow. Unfortunately, stations in the 100 to 300 sq. km. range were not found. The tests consist of comparing the statistics of the observed base peak instantaneous series which were recorded at these ten locations against the synthesized flow series from the complete daily maximum series (assuming only daily maximum data were available) and partial series (assuming that collection of peak instantaneous data started at the station for the later half of the series).

The procedures for synthesizing the data have been described before. The difference for the two exercises was the use of station base factor and peak ratio statistics, if partial peak instantaneous flow series were available, or using regional information for these parameters when only daily maximum information was available. This approach duplicated the situation that exists for the rest of the stations. A comparison of the statistics is presented in Table 4.1.3.1. These include mean, standard deviation and skewness coefficient.

It is observed that either synthetic flow series reproduced the basic statistics of mean and standard deviation which are almost the same as the base case. There is a slight shift in the computed coefficient of skew. This shift is quite random in the limited testing and therefore no definite conclusion can be drawn.

TABLE 4.1.3.1

Comparison of Basic Statistics

Station	Area	Statistics of Base Series			Statistics of Partially Synthesized Series			Statistics of Fully Synthesized Series		
(Number)	(Note)	Mean	Std. Dev.	Skew	Mean	Std. Dev.	Skew	Mean	Std. Dev.	Skew
02AA001	1550R	136	59.4	0.85	135	60.6	1.08	135	59.6	1.09
02BD003	1930N	175	65.9	1.51	174	66.0	1.48	175	66.2	1.45
02GD003	1450R	368	129.0	0.10	368	124.0	-0.02	366	123.0	0.08
02GA024	59.6R	18	11.2	1.29	20	14.0	1.19	21	15.3	0.87
02GA003	3520R	587	326.7	1.17	589	340.5	1.43	586	311.2	1.14
02FC001	3960N	609	210.5	0.24	616	219.0	0.19	612	218.0	0.30
02GD016	518R	79	41.0	1.11	80	42.0	0.98	80	42.0	1.05
02HC003	63.2N	32	11.5	0.52	30	11.2	1.03	30	11.5	1.16
02HL001	2620R	210	70.9	0.25	210	71.1	0.25	210	71.4	0.28
02LJ001	8940N	912	245.0	2.08	913	244.4	2.08	911	239.7	2.03

N - Natural flow
R - Regulated flow

A second test was devised wherein the T-year flood estimate for the two synthetic flow series were compared against the same estimates for the recorded peak instantaneous flow series. In Table 4.1.3.2, such comparison is shown for the 50-year and 100-year flows. Prior to carrying out the Single Station Analysis for these ten stations, the routine nonparametric tests described in Section 4.1.4 of this report were employed to check for stationarity, homogeneity and trend. In all cases the fitted 3 Parameter Lognormal distribution (3PLN) was used to estimate the flows. When outliers were detected in the data sample, the conditional 3PLN was used.

As in the case of basic statistics, it was found that the two synthesized flow series exhibited the properties which led to estimates very close to the base case. The only exceptions were the two small watersheds, namely, Laurel Creek at Waterloo (02GA024) and Mimico Creek at Islington (02HC003). In these two cases, the estimated flows varied from -17% (partial synthesis, 02GA024) to +26.8% (full synthesis, 02HC003). Even in these cases the other synthesized series provided acceptable results. In all other cases the flows were within 5% of the base case. The synthesized estimates, again, did not exhibit any bias one way or another. The estimates clustered around the base case with some values overestimating and others underestimating. It can be concluded that the estimates from synthetic flow series are generally representative of the actual flow series.

Further investigations of the three flow series, for the two smaller stations, revealed the problems associated with a relatively short data base, rapid urbanization of the watershed and negative skew coefficient for the 3PLN distribution fit. Several other points which are also common to all synthesized flows are as follows:

TABLE 4.1.3.2
Comparison of T-year Flood Estimates

Station Number	Area and Note	100-year Flood			50-year Flood		
		Base Case	Partial Synth.	Full Synth.	Base Case	Partial Synth.	Full Synth.
02AA001	1550R	326	336	332	293	300	296
02BD003	1930N	406	394	396	360	352	354
02GD003	1450R	687	669	670	645	630	630
02GA024	59.6R	88	73	90	69	62	75
02GA003	3520R	1670	1730	1570	1470	1520	1400
02FC001	3960N	1160	1210	1220	1080	1120	1130
02GD016	518R	219	229	224	192	201	197
02HC003	63.2N	72	77	92	65	67	76
02HL001	2620R	392	393	394	368	368	370
02LJ001	8940N	1730	1720	1710	1570	1560	1550

N - Natural flow
R - Regulated flow

(i) The prediction employing the synthetic flows are better for larger watersheds than smaller watersheds. This is to be expected. It is common for larger watersheds to have the daily maximum and peak instantaneous flows occurring on the same day. On the other hand, for small and/or urbanized watersheds, the two annual maximums do not necessarily occur on the same day. Thus, when the flows are synthesized using the observations either from adjoining stations or from the station itself (if peak instantaneous flows are measured for partial series), the ratio of peak instantaneous to daily maximum for larger watersheds will not be very different from other years or from similar watersheds. For smaller watersheds, the synthesis procedure uses the daily maximum flows and flows on preceding and following days.

If the maximum instantaneous (MID) and annual maximum daily mean (MD) flows have differed by more than two days, then for such recording station, the daily flow would be less than the maximum for the year. In such situations the ratio of the MID to the daily flow for that day would be higher than that between MID and MD flows. It is possible that the flow series generated for smaller watersheds tend to slightly underestimate the flow series. The preceeding observation is also quite contrary to the commonly held notion that this procedure leads to an overestimate of the sample statistics. Similar observations and arguments can also be made for other procedures used in obtaining peak instantaneous T-year estimates by employing Fuller's Formula or other regression methods.

This was evident for the two stations where the base case and synthetic flow series have quite different dates of occurrence. There are no sure ways to overcome this difficulty with available techniques.

(ii) Synthetic flow based estimates are better for regulated flows than for natural flows. This is, again, to be expected as the regulated flows exhibit little variation between MID and MD ratios from year to year.

(iii) Synthetic flow estimates for snowmelt runoff events are significantly better than those for rainfall events.

Following the findings of Sangal (1981) and the testing carried out as the necessary basics for this study, it was concluded that the synthetic flows, sample statistics and T-year estimates, generated by the procedures described are acceptable.

4.1.3.2 Estimation of Missing Flow Data

A few stations in the data base had missing data during the period of record and these were estimated by correlating flow data with those of a nearby station having an overlapping period of record. The best correlations observed were those obtained using stations of comparable drainage area and experiencing a similar flood generating phenomenon to the station under consideration. Scatter plots generally indicated a weak correlation due to a shortage of suitable stations with an overlapping data period.

Data estimated by this method were only used if:

(a) it was desirable to extend a relatively short data period with gaps in the series;

(b) a substantial portion of the sample would have to be omitted because of gaps; and

(c) the maximum for the period of record was located in the missing data.

An alternative method using Program ISTORIC (Condie et al. 1981) was used to analyse records with missing data and/or having extreme values separated from the main data set, but this was not considered appropriate for most of the stations affected.

As shown on Table 4.1, a total of 34 stations had at least one year of data which was estimated by correlation; nine of these were classified as heavily regulated and not used in the RFFA.

4.1.4 Statistical Testing of the Composite Data Base

4.1.4.1 Tests for Independence, Trend, Homogeneity & Randomness

It was necessary to carry out statistical tests on the data samples prior to frequency analyses in order to verify that the samples were composed of independent, random events from homogenous populations. A computer program, "NONPARA" (Shiau et al. 1980), was used in this study to check the data for compliance with the above condition using the following nonparametric tests:

(1) Spearman Rank order serial correlation coefficient test for independence
(2) Spearman Rank order correlation coefficient test for trend
(3) Mann-Whitney split sample test for homogeneity
(4) Wald-Wolfowitz split sample test for homogeneity
(5) Runs above and below the median test for general randomness

For a description of the above tests, see Appendix C1.

Stations having less than 10 years of data were not tested. After the initial tests were carried out on 416 stations, it was found that one or more of the tests indicated that there were data deficiencies having statistical significance for 63 station samples as summarized below:

Sample not Independent	- 11 cases
Sample Trend detected	- 8 cases
Sample not Homogeneous	- 19 cases
Sample not Random	- 38 cases

Data were removed from the sample during the earlier data years until all the tests were satisfied or only ten years of data remained. If a considerable amount of data had to be removed, it was removed starting at the final data year instead and working backwards. The sample with the larger period of record remaining after data was deleted to pass the tests was used. In one case, the sample was divided into two separate overlapping periods. In addition to the 416 stations initially analysed, 19 additional analyses were carried out when previously analysed stations were split into separate periods as discussed, or split to separate a period during which flow became regulated (denoted as 'hybrid' stations in the following). Also data for two stations on the same stream were combined in several cases to give a longer period of record when their drainage areas were not significantly different. Several stations in the Grand River Watershed also had naturalized flows included separately.

Data years which had to be deleted from station samples to pass the tests are shown in Table 4.1.0. along with the stations which still failed after the above procedures were attempted.

A total of 17 stations fall into the latter group. The nonparametric tests indicated a statistically significant deficiency in the data for these stations as shown on Table 4.1.4.1 and summarized below:

Sample not Independent	- 0 cases
Sample Trend detected	- 2 cases
Sample not Homegenous	- 10 cases
Sample not Random	- 11 cases

A total of 400 different stations and 19 'hybrid' stations were used in the foregoing analyses.

Table 4.1.4.1
Stations Which Continued to Fail Nonparametric Tests
After Data was Deleted from the Sample

Station Name	WSC No.	Nonparametric Tests			
		MW	WW	RAB	SROT
Beaver Creek near Marmora	02HK006	-	X	S	-
Blackwater River at Beardmore	02AD010	S	X	-	-
Blanche River at Swastika	02JC009	-	X	S	-
East River near Huntsville	02EB013	$	X	-	-
La Vase River at North Bay	02DD013	-	X	S	-
Little Don River near Lansing	02HC004	S	-	-	S
Mackie Creek near Stephens Gulch	02HD222	S	S	S	-
Magnetawan River near Britt	02EA011	-	X	S	-
Nottawasaga River near Alliston	02ED101	-	X	S	-
Perch Lake Inlet No.5 near Chalk R.	02KA008	$	X	S	-
Severn River at Limestone Rapids	04CC001	S	-	-	-
Severn River at outlet of Muskrat Dam Lake	04CA002	$	-	-	-
South River at South River	02DD009	$	X	S	-
Venison Creek near Walsingham	02GC021	-	X	S	-
Wilmot Creek near Leskard	02HD231	S	S	S	-
Wolfe River at Highway No. 17	02AC001	S	-	-	S
Wye Creek near Thorndale	02GC013	-	X	S	-

Legend

S	significant at 5% level and 1% level
$	significant at 5% level only
-	OK
X	test not done (sample ties)
MW	Mann-Whitney split sample test for homogeneity
WW	Wald-Wolfowitz split sample test for homogeneity
RAB	Runs above and below the median test for general randomness
SROT	Spearman rank order correlation coefficient test for trend

4.1.4.2 Tests for High and Low Outliers

Outliers in the data sample may unduly bias the fitted frequency distribution and lead to poor estimates of the T-year event. It was, therefore, necessary to identify these values. The Grubbs and Beck outlier test was used on the log transform of the data samples employing the computer program "OUTLIER". Information on this test can be found in Pilon (1982). As before, stations having less than ten years of data were not tested. Outliers detected in the data were as follows:

(1) Low Outliers - detected in the samples of 89 stations.

(2) High and Low Outliers - detected in the samples of 15 stations.

(3) High Outliers - detected in the samples of 39 stations.

The above stations are shown on Table 4.1.0.

4.1.5 Effects of Dams on Flow Data

Design and Operation

Dams are built for a number of different applications. Some dams are built primarily to enhance recreational activities. These dams are often used to raise water levels to permit navigation throughout the summer and/or maintain a steady water level for shore uses. Dams designed for this purpose are often a wier structure with removeable stoplogs and are common in central Ontario. They can be useful in reducing high flows if they are actively managed but many of these dams are not operated with this objective in mind. Regardless of how these dams are operated, the lakes that they control do provide some attenuation of high flows.

A number of multi-purpose dams have been built in Ontario, particularly by conservation authorities in southern Ontario. These dams are typically designed and operated to provide a combination of flood control, low flow augmentation and recreational opportunities. Fanshawe Dam on the Thames River and Guelph Dam on the Speed River are typical examples. Dams of this type usually have a large amount of storage capacity which can significantly reduce high flows.

Dams built to facilitate power production are common in central and northern Ontario. Some of these dams provide head for the generators but have very little storage capacity. Others have a large storage capacity either at the location of the generating station or upstream of the station. Old mill dams, which are usually smaller, would also fall in this category. Power dams with a large storage capacity are likely to significantly reduce snowmelt runoff as filling of the reservoirs occurs at this time. Their ability to reduce flows from extreme summer rainfall events is dependant on the storage capacity available at that time.

Some dams have been built to store water for irrigation of farmland. These dams are primarily in the "tobacco belt" area of southern Ontario. Typically these dams are very small and have minimal effect on high flows.

Classification Criteria

There are four main factors that determine the effect that a dam has on the flow at a downstream gauge: the method of operation of the dam; the storage capacity of the dam (surface area multiplied by depth); the area of drainage basin above the dam; and the drainage basin area above the gauge.

The area above the dam and above the gauge and the surface area of the reservoir were considered in determining the effect of the dam on flow data. Two factors not considered were the method of operation of the dam and the depth of storage at the dam. While it is recognized that the omission of these factors is a shortcoming in the analysis, the tremendous effort that would have been required to obtain this information for all of the dams was not feasible.

A regulation factor (RF) was computed for each gauge for which the flow is affected by regulation. RF was computed in the following manner:

$$RF = \sum_{i=1}^{i=n} \frac{ACi \times ARi}{AG^2}$$

where:

RF = regulation factor

AC = drainage basin area controlled by dam i

AR = surface area of reservoir behind dam i

AG = drainage area at gauge

n = total number of dams considered

Gauges affected by regulation were divided into three categories according to the magnitude of the regulation factor. If RF was less than 0.03 then the gauge was given the designation R1. If RF was between 0.03 and 0.1 then the gauge was designated R2. Finally, if RF exceeded 0.1 then the gauge was designated R3.

The impact of regulation on the flow records of gauges with an R1 designation was considered to be negligible and the gauge data were used for all aspects of the analysis. The data were treated as if they were from a "natural" gauge. Data for gauges with an R2 classification were considered to be moderately affected by regulation.

The data were used for all aspects of the analysis but a separate "regulated" category was established for these gauges for the regional analysis.

Gauges with an R3 classification were considered to be highly affected by regulation. These stations were omitted from the regional analysis.

Stations that were significantly affected by the diversion of flows, either into or out of the drainage basin, were designated as R4 and were only included in the single station analysis.

The establishment of the ranges of RF for the different designations were primarily arbitrary. Useful information in this regard did exist for gauges on the Grand River. The flow records for some of these gauges were naturalized as part of a study by the Grand River Conservation Authority (Minshall, 1983). A flow frequency analysis of both the recorded and naturalized data was also done for the same study. For the gauge at Brantford, the event with a 100 year recurrence interval was equivalent to 2,270 m^3/s for the naturalized data and 1,760 m^3/s for the recorded data. It is evident that the dams have a very significant effect on the flow data at this gauge. Since the operating plan for the dams affecting this gauge has flood mitigation as one of its main objectives, and since the dams have a relatively large depth of storage, it is likely that the impact of these dams on the flow is large relative to the RF.

Dams at other locations with a larger RF may have a smaller effect on high flows due to operational procedures.

Table 4.1.5.1 summarizes the number of gauges in each category.

Table 4.1.5.1
Gauge Classification

	N	R1	R2	R3	R4
Southern Ontario	120	33	39	90	1
Northern Ontario	51	2	5	50	6

4.2 Method of Analysis

4.2.1 General

The composite data base (MID and QPP) was tested as discussed in Section 4.1.4 and stations ultimately failing the nonparametric tests were not analyzed further. Frequency analysis was carried out on the remaining 400 stations and 19 'hybrid' stations as described in the foregoing. Three computer programs, namely FDRPFFA (Condie et al. 1976), LOWOUT (Cheng et al. 1981), and ISTORIC (Condie et al. 1981), were used in this analysis to rank the data and compute data statistics for the normal and transformed data sample. One or several probability functions were subsequently fitted to the appropriately transformed data parameters using the maximum liklihood method or the method of moments if the former was not possible. Flood estimates for different recurrence intervals were then computed using the fitted distribution and finally plots showing the data fit were generated. Program FDRPFFA uses several distributions and data transforms to fit the data: Gumbel, Lognormal, Three-Parameter Lognormal, and Log Pearson Type Three. Procedures utilized for the program FDRPFFA are described in the reference cited above.

A typical FFA plot and table of computed parameters for all distributions generated by Program* FDRPFFA are shown in Figure 4.2.1.

SAMPLE OF OUTPUT FOR FFA FROM PROGRAM FDRPFFA

PIGEON RIVER AT MIDDLE FALLS 02AA001

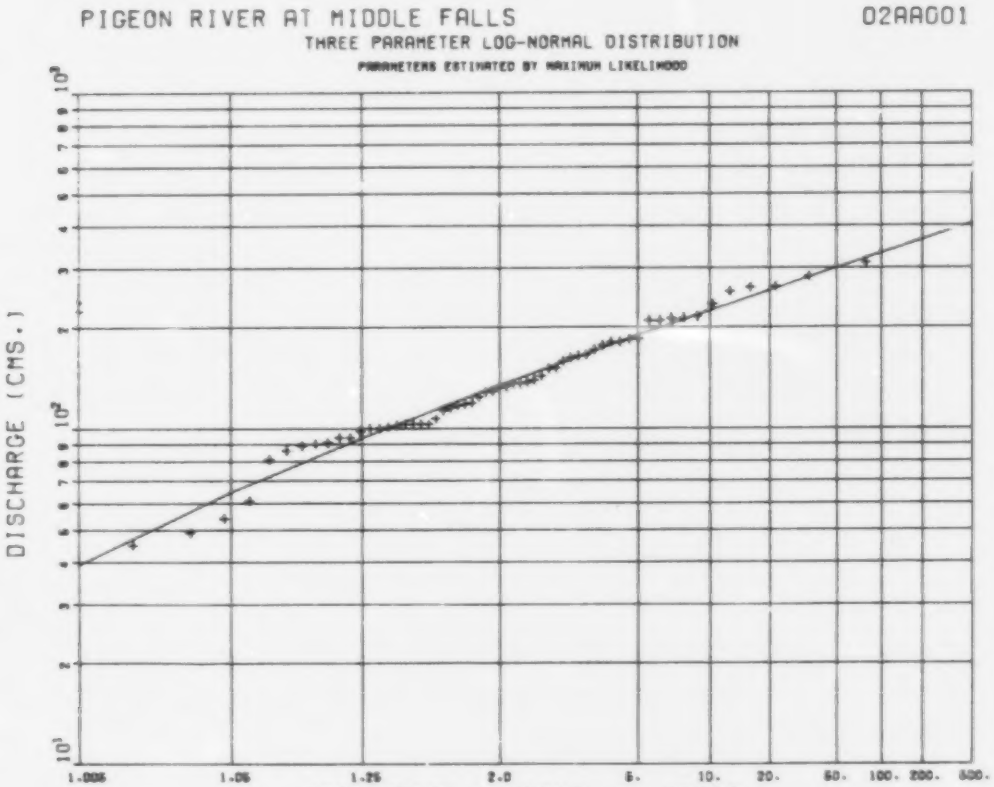
DRAINAGE AREA = 1550.0 SQ. KM.
---NATURAL FLOW---
PERIOD OF RECORD = 1924 - 1982

SAMPLE STATISTICS
MEAN = 143. S.D. = 59.5 C.S. = .8315 C.K. = 3.5023
SAMPLE STATISTICS (LOGS)
MEAN = 4.8816 S.D. = .4214 C.S. = -.2498 C.K. = 3.3085
SAMPLE MIN = 45. SAMPLE MAX = 311. N = 59

PARAMETERS FOR GUMBEL I A = .0214E02 U = 116.
PARAMETERS FOR LOGNORMAL M = 4.8816 S = .4214
PARAMETERS FOR THREE PARAMETER LOGNORMAL A = -27. M = 5.0810 S = .3437
STATISTICS OF LOG(X-A)
MEAN = 5.0810 S.D. = .3437 C.S. = -.0187 C.K. = 3.0494
PARAMETERS FOR LOG PEARSON III BY MOMENTS A = -.0526 B = .6412E+02 LOG(M) = 8.2560
ME= .3851E+04
PARAMETERS FOR LOG PEARSON III BY MAXIMUM LIKELIHOOD A = -.0560 B = .5425E+02
LOG(M)F= 7.9614 M = .2868E+04
DISTRIBUTION STATISTICS MEAN = 4.8816 S.D. = .4182 C.S. = -.2715

RETURN PERIOD	GUMBEL I F.E.	GUMBEL I S.E.P.	LOGNORMAL F.E.	LOGNORMAL S.E.P.	THREE PARAMETER LOGNORMAL F.E.	THREE PARAMETER LOGNORMAL S.E.P.	LOG PEARSON III MAX. LIKELIHOOD F.E.	LOG PEARSON III MAX. LIKELIHOOD S.E.P.	LOG PEARSON III MOMENTS F.E.	LOG PEARSON III MOMENTS S.E.P.
1.005	38.		45.		39.		48.		40.	
1.050	64.		66.		64.		64.		64.	
1.250	94.		93.		93.		93.		93.	
2.000	134.		125.		134.		134.		134.	
2.333	143.	5.38	142.	5.53	144.	5.67	145.	5.78	145.	5.90
5.000	186.	5.88	188.	6.38	188.	6.96	188.	6.89	189.	6.98
10.000	222.	6.35	226.	7.40	221.	8.66	222.	8.46	223.	6.71
20.000	255.	6.74	264.	8.42	256.	8.30	254.	7.75	256.	8.05
50.000	299.	7.16	313.	9.67	299.	10.30	293.	9.89	296.	10.50
100.000	331.	7.47	351.	10.60	331.	11.80	321.	11.80	329.	12.60
200.000	364.	7.64	390.	11.40	363.	13.40	348.	13.80	354.	14.80
500.000	407.	7.88	444.	12.40	406.	15.40	384.	16.50	391.	17.90

F.E.= FLOOD ESTIMATE(CMS)
S.E.P.= STANDARD ERROR PERCENT



FLOOD FREQUENCY ANALYSIS - ANNUAL FLOOD SERIES
FIGURE : 4.2.1

4.2.2 Selection of Probability Distribution Function

It was mentioned in Section 4.2.1 that several probability distribution functions were fitted to the data using computer program* FDRPFFA (Sangal and Kallio 1977; Condie 1976, 1980). Studies carried out in the past have identified the Three-Parameter Lognormal (3PLN) distribution, as giving the best overall fit to flood series in Ontario. This distribution was therefore selected for this study following an inspection of the results. The Log Pearson Type Three (LP3) distribution gave a comparable performance and it was used for comparison with the selected fit whenever possible. It is necessary when using the Index Flood Method for Regional Flood Frequency Analysis (described in Section 5.0) to fit a common probability distribution to all the samples collected in the defined region. This could not be done if the untransformed data sample was negatively skewed, as no solution for fitting the probability distribution was possible under those conditions. Consequently, the Two-Paramater Lognormal (LN) distribution was used as an alternative since it represents a special case of the 3PLN distribution when the parameter "a" is zero. A perfect fit is said to be achieved using the LN and 3PLN transforms if the values of skew and kurtosis are equal to the theoretical values of 0.0 and 3.0 respectively.

The LN distribution was also used when a high negative skew was evident in the 3PLN transformed data indicating a poor fit and if the LN distribution yielded a skew closer to the theoretical value of 0.0. At high negative skews the flood estimates at the higher recurrence intervals were usually grossly overestimated by the 3PLN distribution.

* Program modified to produce different output format from the original version.

Under these circumstances, much closer agreement was generally found to occur between the estimates of the LN distribution and the LP3 distribution than between the LP3 and the 3PLN distribution.

Stations identified as having outliers using the methods discussed in Section 4.1.4.2 were analyzed with the aid of computer programs designed to account for these anomalies using special statistical techniques. Selection of the appropriate program for the type of outliers encountered and the techniques employed in these analyses are described in Section 4.2.3. These programs, LOWOUT and ISTORIC, also use the 3PLN distribution but do not include other different probability distributions to enable comparison of the various fits. The sample skewness, kurtosis, and plot showing the data with fitted distribution were reviewed for goodness of fit. Several samples which gave poor fits were analyzed using program FDRPFFA ignoring any outliers, and the LN fit was used if it was significantly better. The skews, kurtosis and plots were reviewed for all the stations analyzed including those not having outliers and the LN fit selected if it proved better. Consequently, the data samples for 41 stations were fitted using the LN distribution. Sixteen of those stations were classified as being heavily regulated. The remaining 22 stations had a mean period of record of 15.28 years with a standard deviation of 4.22 years and a maximum period of 26 years (for Station 02HA003).

The stations selected for the regional analysis had data giving the following statistics before and after logarithmic transforms were applied:

TABLE 4.2.2.1

COMPARISON OF SKEW AND KURTOSIS

Case	Total Number of Stations	Untransformed Data skew/kurtosis Mean	Untransformed Data skew/kurtosis Std. Dev.	Log Transform skew/kurtosis Mean	Log Transform skew/kurtosis Std. Dev.
All Stations included	395	0.89 / 4.33	0.80 / 1.84	-0.07 / 3.62	0.26 / 1.03
Heavily Regulated Stations excluded	249	0.91 / 4.39	0.83 / 1.85	-0.08 / 3.69	0.23 / 1.05

It can be seen from the above table that the transformed data show an overall improvement in fit with respect to the theoritical values of skew and kurtosis. The above parameters and other useful information for each station may be found in Appendix A (Tables A14.1 and A14.2.) Also, the statistics of these parameters grouped on a regional basis are shown in Tables A1.1 to A13.7.

A visual inspection of the data plots (Volume 3 - Appendix I) for each station was made to help determine the goodness of fit for the selected distribution. This yielded a somewhat subjective assessment shown in the following table.

TABLE 4.2.2.2.

SUMMARY OF RATINGS FOR PLOT FITS

	Number of Stations Rated				
V. Poor	Poor	Poor-Fair	Fair	Fair-Good	Good-Excellent
4	21	44	76	3	247
1.0%	5.3%	11.1%	19.2%	0.7%	62.5%

SAMPLE OF OUTPUT FOR FFA FROM PROGRAM LOWOUT

MIDDLE MAITLAND RIVER NEAR LISTOWEL 02FE003

DRAINAGE AREA : 77.7 SQ. KM.
REGULATED FLOW : CLASS 2
PERIOD OF RECORD : 1953 - 1979

FLOOD FREQUENCY ANALYSIS - ANNUAL FLOOD SERIES

SAMPLE PARAMETERS	MEAN	SD	CS	CK
X SERIES	37.	18.	.543	3.601
LN X SERIES	3.49	.57	-1.007	5.369

X(MIN): 7. CMS. TOTAL SAMPLE SIZE= 27
X(MAX): 79. CMS. NO. OF OUTLIERS= 1

AFTER REMOVAL OF OUTLIER(S)

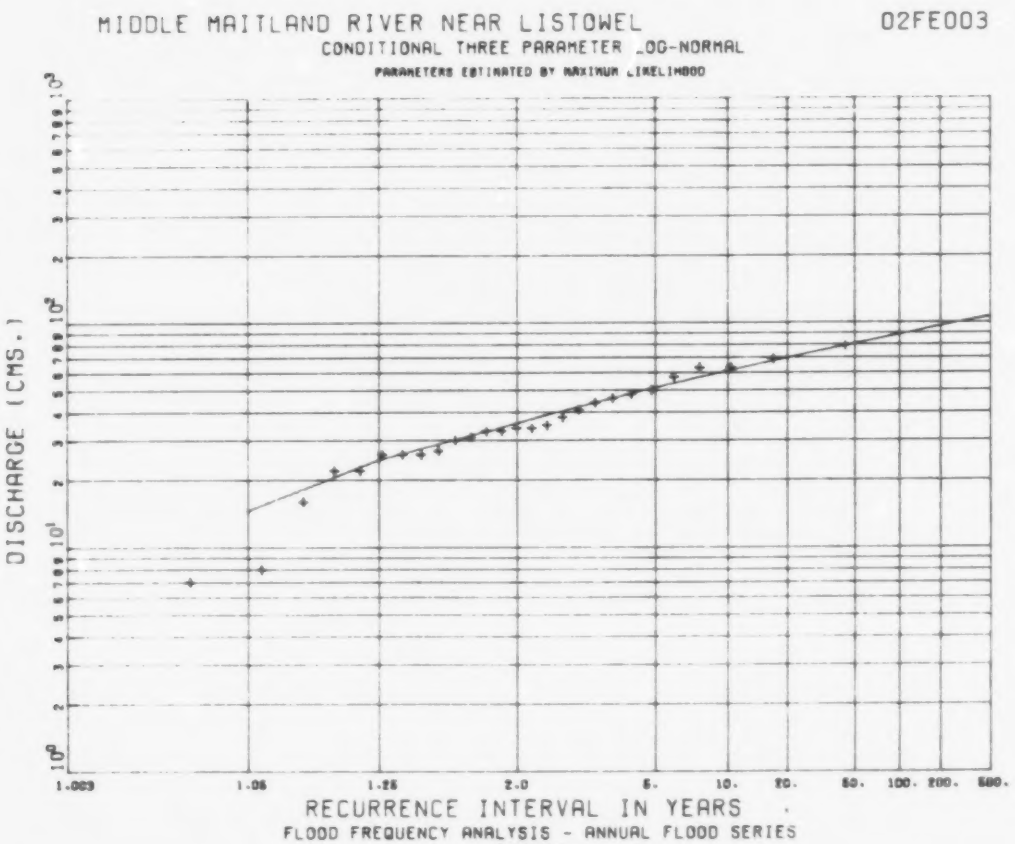
SAMPLE PARAMETERS	MEAN	SD	CS	CK
X SERIES	39.	17.	.665	3.686
LN X SERIES	3.55	.49	-.868	5.636
LN (X-A) SERIES	4.13	.26	-.078	3.673

CONDITIONAL PROBABILITY FUNCTION (MAXIMUM LIKELIHOOD)
PARAMETERS A = -26.0150 M = 4.1341 S = .2613

FLOOD FREQUENCY REGIME

CONDITIONAL THREE PARAMETER LOGNORMAL
(MAXIMUM LIKLIHOOD)

RETURN PERIOD	EXCEEDANCE PROBABILITY	FLOOD CMS.
1.003	.997	-
1.050	.952	15.
1.250	.800	25.
2.000	.500	36.
2.330	.429	39.
5.000	.200	51.
10.000	.100	61.
20.000	.050	70.
50.000	.020	80.
100.000	.010	88.
200.000	.005	96.
500.000	.002	106.



FLOOD FREQUENCY ANALYSIS - ANNUAL FLOOD SERIES
FIGURE : 4.2.2

4.2.3 Analysis of Data Samples Having Outliers

Three outlier conditions were described in section 4.1.4.2:

(1) Low outliers detected in sample

(2) High and low outliers detected in sample

(3) High outliers detected in sample

For conditions (1) and (2), computer program LOWOUT (Cheng et al. 1982) was used for the analysis. If historical information was available on the high outliers identified for condition (2), analysis for this condition was undertaken using computer program ISTORIC (Condie et al. 1981).

Historic information was not available for all of the samples falling under conditions (1) and (2) and these were analyzed using program LOWOUT. Computer program LOWOUT employs a conditional probability function to effect the removal of low outliers identified in the sample and the Three-Parameter Lognormal distribution was then fitted to the remaining samples. Details of procedures utilized and other information about this program may be found in the references cited. A typical FFA plot and title of computed parameters generated by program *LOWOUT is shown on Figure 4.2.2.

For condition (3) computer program ISTORIC was used if historical information was available on the high outliers identified. This was available for data of only 4 stations in the study and the remaining samples were analyzed using computer program FDRPFFA.

Program ISTORIC uses censoring and maximum likelihood theory to estimate the parameters for the Three-Parameter Lognormal (3PLN) distribution.

*Program modified to produce a different output format from the original verision.

The following information is required: (a) the period over which the flood, detected as a high outlier, was not exceeded; or (b) knowledge that historical floods of known magnitude were not exceeded during a period of missing data followed by continuous records. The latter option was used for two of the four stations. Details of procedures utilized and other information on program ISTORIC may be found in the reference cited. A typical FFA plot and table of computed parameters generated by program* ISTORIC is shown on Figure 4.2.3.

*Program modified to produce a different output format from the original verision.

SAMPLE OF OUTPUT FOR FFA FROM PROGRAM ISTORIC

FLOOD FREQUENCY ANALYSIS - ANNUAL FLOOD SERIES

HUMBER RIVER AT WESTON 02HC003

DRAINAGE AREA : 800.0 SQ. KM.
REGULATED FLOW : CLASS 1
PERIOD OF RECORD : 1952 - 1982

SAMPLE PARAMETERS	MEAN	SD	CS	CK
X SERIES	172.	243.	5.171	31.294
LN X SERIES	4.85	.66	1.058	9.571
LN (X-A) SERIES	4.80	.69	.820	9.160

3 PARAMETER LOGNORMAL WITH CENSORING

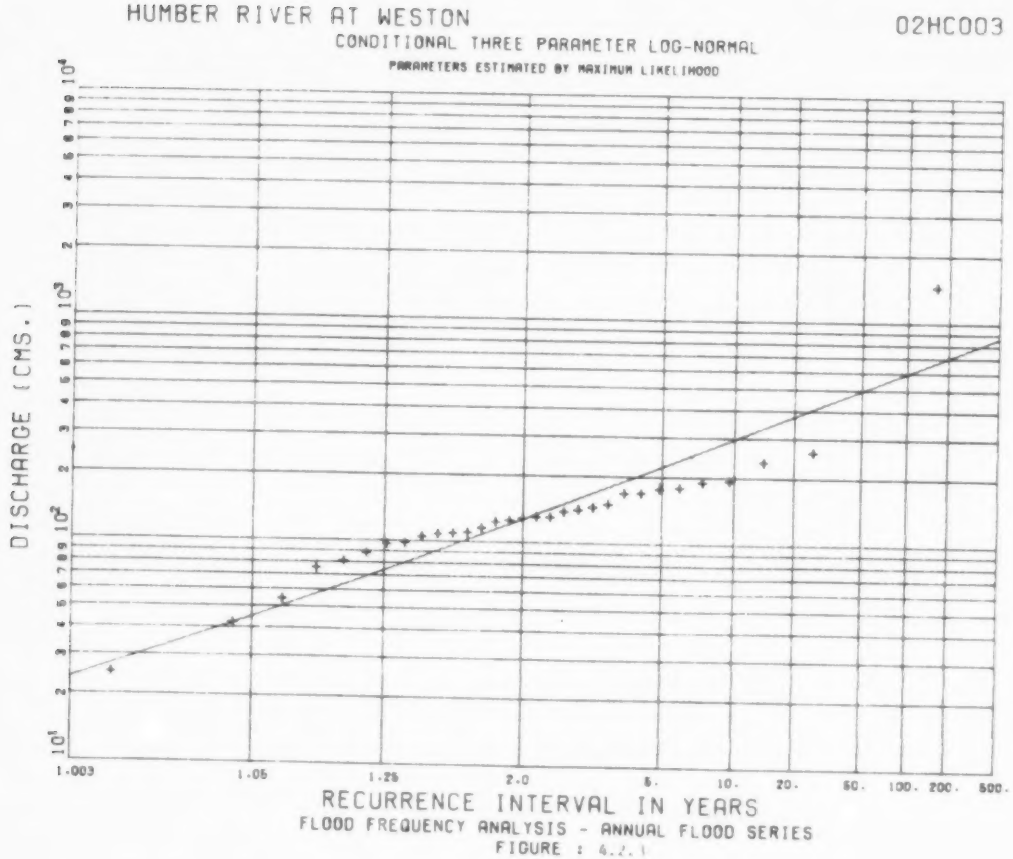
PARAMETERS A = 4.7827 M = 4.7998 S = .6783

MEAN = 158. SD = 117. CS = 2.739 CK = 18.778

UPPER LIMIT X = 24.3750
LOWER LIMIT X = -.6250

FLOOD FREQUENCY REGIME

RETURN PERIOD	EXCEEDANCE PROBABILITY	FLOOD
1.003	.997	24.
1.050	.952	45.
1.250	.800	73.
2.000	.500	126.
2.330	.429	142.
5.000	.200	220.
10.000	.100	295.
20.000	.050	376.
50.000	.020	494.
100.000	.010	593.
200.000	.005	701.
500.000	.002	862.



FLOOD FREQUENCY ANALYSIS - ANNUAL FLOOD SERIES
FIGURE : 4.2.1

4.3 Comparison With Previous Investigations

Several large studies (Sangal et al, 1977; MacLaren, 1981; Cumming -Cockburn, 1981) have been carried out previously in Ontario on the subject of Flood Frequency Analysis. The more recent studies have mainly sought to identify the most suitable analytical techniques to employ for frequency analyses in the province and have used stations having at least 20 years of data for verification. All of the above mentioned studies have favoured the Three-Parameter Lognormal distribution which was also used in the study and have used daily maximum flow data and peak instantaneous flow data if available.

Relationships using various basin parameters and the maximum daily flow would subsequently be derived to enable estimation of peaks at stations where this information was not available.

Further comparison will only be made with the study by Sangal and Kallio (1977) referred as TB99.

Available data up to 1971 was used in that study along with a few stations which were updated to 1974. The following summarizes the main differences between the single station analyses carried out for the two studies:

Item	This Study	TB99
1. Study area	Ontario	Southern Ontario
2. Total No. of Stations analysed +	482	172
3. Total No. of Stations selected for Regional Analysis (Southern Ontario)	238	104
4. Data used for Frequency Analysis	Annual maximum peaks (synthetized if necessary)	Annual maximum mean daily flows
5. Data tests	Yes	No
6. 2-Parameter Lognormal used if no fit possible	Yes	No
7. Index Flood	2 year return period flood (median)	Arithemetic Mean Annual flood

+ Stations with less than 10 years data, heavily regulated stations and those failing nonparametric tests included in analysis.

4.4 Summary of Results and Conclusions

Data samples for 482 stations were initially selected for analysis. Annual maximum daily mean flows were converted to peak flows if this data was not available. In order to confirm that the procedures used for synthethizing the peaks were acceptable, tests were carried out on ten stations as described in Section 4.1.3.1. These tests indicated that the synthetic peak data had similar data statistics and generated flood estimates for various return periods close to those derived from the actual peak data. These composite data samples having at least 10 years of records were tested for independence, trend, homogeneity and randomness using nonparametric tests. These tests initially revealed that 63 stations failed to satisfy some or all of the nonparametric tests. That number was reduced to 16 after varied amounts of data, as required, were removed from each of the 63 samples which initially failed the tests.

A total of 399 stations plus 19 'hybrid' stations remained when the above process was completed after which further tests were employed to detect the presence of high and low outliers.

Outliers were detected in 143 samples. Single Station Flood Frequency Analysis for 104 of these was subsequently carried out using special statistical techniques to remove the bias caused by the low outliers. Other specialized techniques utilizing historical information were also employed in the analysis of 4 other stations to give a better fit to samples having high outliers or discontinuous data.

The results of the Single Station Flood Frequency Analysis have indicated that the Three-Parameter Lognormal (3PLN) distribution generally gave a good fit to the discharge data in Ontario (as shown on Tables 4.2.2.1 and 4.2.2.2). The Two-Parameter Lognormal (LN) distribution was substituted in the event that a poor fit or no fit was obtained when the 3PLN fit was attempted.

The following may be concluded from the foregoing:

(i) The synthethized peak flow data used in the analyses was free of any significant bias.

(ii) The station samples used in the single station analyses contained data which were independent, free of trend, homogenous and random.

(iii) The fitted probability distributions were not biased by the presence of low outliers.

(iv) In the majority of cases where high outliers were detected in the samples, it was not possible to account for them using the special techniques available due to lack of historical information. The fitted frequency distribution for these stations will tend to overestimate the various return period flows, the severity of which will depend on the magnitude of the outlier relative to the other data values.

(v) The 3PLN distribution gave a good fit to the flow data and when the LN distribution had to be utilized it generally gave a fair fit.

(vi) A total of 395 stations were selected for the Regional Flood Frequency Analysis. Of these, 238 stations were selected for use in developing regional relationships, 9 stations were reserved for testing the regional relationships and the remainder were omitted as they were considered to be too heavily regulated or were not suitable for other reasons.

5.0 REGIONAL FLOOD FREQUENCY ANALYSIS

It is a common practice to employ the Single Station Frequency Analysis estimate when the length of record is long, usually in excess of twenty-five years; however, flood records at most gauging stations are generally short. Such short records are accompanied by a correspondingly large time sampling bias. Furthermore, it is quite rare that the design flow estimates are required at gauging locations. Normally the information is required at an ungauged site or at other points of a gauged basin. In such situations it is quite popular to utilize regional information based on frequency analysis of a number of streams in hydrologically similar regimes.

The transformation of regional information can be either at an ungauged site or at a location with its own short record. Basically, there are two methods for carrying out Regional Frequency Analysis: (i) Index Flood Method, and (ii) Regionalization by Multiple Regression Analysis.

The Index Flood Method, as the name suggests, requires the development of an index flood frequency curve, which is based on the frequency curves of all stations in a homogeneous region. The determination of a homogeneous region is based on the assumption that watersheds within such a region exhibit similar statistical properties. Initially, the Index Flood Method was developed by Dalrymple (1960) employing Gumbel I as the best distribution. Condie (1980) extended the methodology to Three-Parameter Lognormal distribution. The details of the procedure employed in this study where 3PLN was the best distribution can be found in Condie (1980).

In recent years with the advent of computer program packages such as BMD and SPSS, the regionalization by Multiple Regression Analysis technique has become quite popular. The procedure requires the regression of several T-year estimates at gauged locations against a number of physiographic and climatic variables.

Based on this regression, relationships are developed among T-year flood flow as the dependent variable and significant physiographic and climatic parameters as independent variables. The popularity of this method can be assessed from the fact that most of the states in the U.S. now have carried out these studies and developed "State Equations".

In this chapter, the procedures as applied and modified for the Index Flood Method are discussed. Procedures utilized for the Multiple Regression Analysis are detailed in Chapter 6 and are the subject of Volume 2 of this report.

5.1 Index Flood Method

As noted in the previous section, Index Flood Method is one of the most popular methods employed in estimating flows for ungauged watersheds. This is evidenced by its wide employment in U.S. Geological Survey Studies, (1960); U.K. Flood Report, (1975); New Brunswick, (1977); and Nova Scotia, (1980) FDR Programs and Sangal and Kallio (1977).

The steps involved in carrying out this exercise follow Langbeins' (1960) homogeneity test procedure. The homogeneous regions were initially set in line with those identified by Sangal and Kallio (1977). The northern region was initially set as one region. Later, homogeneity tests dictated that this region be further divided up into smaller areas. The final configuration showed that there were twelve regions in Ontario. These are presented in Figure 5.1.1. The number and size of regions compare quite favourably when comparisons are made to other available studies.

The homogeneity test was carried out with the annual mean or the index flood as the one associated with a 2-year return period, or Q2. Secondly, the 10-year return period, Q10, was used as the one that can best be estimated with the length of record. This was a deviation from the New Brunswick Study where a 20-year flood was utilized.

The homogeneity tests were carried out in an iterative fashion. If the stations at the boundary of the regions were not falling under the homogeneity bell curve, then the regions were adjusted to discard a station or include one from the adjoining region. This was repeated until very few border station fell outside the bell curve. When a station within the region was found to fall outside of the curve, the distribution was inspected to explain the reason for this deviation. In most of the cases it was the length of record, usually very short, 11 or 12 years. In some cases it was observed that 3PLN was employed although the skewness coefficient was still negative. These stations were, however, kept in further analysis. The curves for the twelve regions are depicted in Figure A1.1 through Figure A12.1.

The next step required the development of the basic or index frequency curve. The premise in establishing the basic curve is that within regions, which are homogeneous with respect to flood producing mechanisms, the individual streams, although differing in drainage areas, have frequency curves with approximately same slope. The frequency curves were reduced to a dimensionless form when the flood peaks for various T-year events were divided by an index flood, Q2, and plotted. All these curves passed through the 2-year frequency where the ratio is obviously 1.0 but have different slopes. This exercise was carried out for two different sets: one for watersheds with little or no regulation; and the other with minor regulation. The average curves for the twelve regions are shown in Figure 5.2.1 to Figure 5.13.1. Tables 5.1.10 to 5.1.21 list the dimensionless ratios and the relative standard error of estimate (SE) for the various dimensionless ordinates. For example, in Region 5, the 100-year dimensionless ordinate is 2.34 and the relative SE is 0.083. The dimensionless ratios for each station are also shown in Figures 5.2.2 to 5.13.2.

The last step in establishing the Index Flood Method is developing the relationship between the index flood and various flood generating mechanisms. Ideally, these mechanisms would include various physiographic and climatic factors. In this study, as a first estimate, the index floods (Q2) versus drainage area were correlated for all watersheds in a homogeneous region. These relationships were developed for the twelve regions. Except for Region 1, which required two different relationships within the range of drainage area, one relationship sufficed for all other regions. One possible reason for Region 1 to have two different relationships is the wide range of drainage areas in this region. Graphical relationships (log-log scale) showing the variation of the index flood with drainage area are presented in Figures 5.2.1 to 5.13.1. Table 5.1.1 shows the same relationship in a close form equation.

When anomolies were detected, either in the equations or in the graphical presentation, visual tests and checks by plotting Q2 versus mean annual runoff (MAR) were carried out. These helped to provide an explanation for the variance from norm.

Plots of the 100-year return period flow versus drainage area (log-log scale) are shown in Figures A16.1 to A16.6 to give an indication of the range of 100-year flows which may occur in each region for a given drainage area. The heavily regulated stations have been included in these plots in view of the fact that the regulation effects would be less significant for the larger floods; whereas regulation would strongly influence the estimates of the more frequent events.

The description of the twelve homogeneous regions is provided in Appendix B.

Table 5.1.1

Regional Regression Equation Coefficients Derived from Plot of Index Flood (Q2) vs. Drainage Area (Log-Log Scale Plot)

General Form of Expression: $Q2 = CA^n$

Where Q2 = 2 year return period (3PLN) flood in cubic metres per second

A = Drainage area in square kilometers

C = Constant

n = Exponent

Region	Constant C	Slope n
1(a)	0.22 ($A < 60$ Km^2)	1.000
1(b)	0.73 ($A > 60$ km^2)	0.707
2	0.51	0.896
3	0.20	0.957
4	0.71	0.842
5	0.45	0.775
6	0.41	0.806
7	1.13	0.696
	1.61 (max)	
	0.40 (min)	
8	0.72	0.785
9	0.40	0.810
10	0.28	0.849
11	0.38	0.706
12	0.59	0.765

Table 5.1.2

Range of Drainage Areas used to develop Regional Relationships

Index Method

Region Number	Drainage Area Range (km^2) Over 9 years data (A)	No.	5-9 years data (B)	No.
1	0.2 - 9270	30	0.11 - 2040	21
2	76.7 - 3816	7	76.1 - 2410	4
3	86.0 - 3960	15	329.0 - 381	3
4	2.5 - 5910	47	38.9 - 1420	4
5	14.2 - 4300	17	159.0 - 202	2
6	51.3 - 697	14	5.2 - 676	6
7	63.5 - 293	8	60.9	1
8	4.9 - 800	37	10.4 - 495	12
9	24.3 - 1520	12	168.0 - 311	2
10	62.9 - 11900	13	18.6 - 2850	5
11	0.7 - 24200	31	389.0 - 736	4
12	4250 - 60100	9	94300.0	1

Note:

1. No.- denotes number of stations in range.

2. Total range for application of regional relationships is the combined range of both columns (A) & (B).

3. Refer to regional plots of Q2 v/s drainage area to ascertain validity of range of application.

4. See Tables A1.1 - A12.1 and A13.8 for additional information on data range.

DATA FOR STATIONS IN REGION 1

STATION NUMBER	STATION NAME	AREA SQ.KM	DATA YEARS	TOT	Q2	RATIO TO INDEX FLOOD (Q2) FOR SELECTED RETURN PERIODS R=1.25	R=2.00	R=5.00	R=10.0	R=20.0	R=50.0	R=100	R=200	R=500	SPQ2
02ME001-	BLOOMFIELD CK. AT BLOOMFIELD	13.9	1970-82	13N	4.2	.93	1.00	1.32	1.60	1.86	2.21	2.48	2.76	3.14	.299
02KF011-	CARP RIVER NEAR KINBURN	263.0	1972-83	12N	62.3	.96	1.00	1.17	1.30	1.42	1.56	1.67	1.78	1.92	.233
02HM005-	COLLINS CREEK NEAR KINGSTON	155.0	1973-82	10N	40.0	.95	1.00	1.24	1.47	1.68	2.00	2.24	2.50	2.87	.252
02ME002-	CONSECON CK. AT ALLISONVILLE	114.0	1970-82*	13N	31.0	.94	1.00	1.26	1.46	1.66	1.90	2.09	2.27	2.52	.275
02000DA-	DUCHESNAY R. NEAR NORTH BAY	90.4	1957-82	26N	21.0	.94	1.00	1.28	1.53	1.75	2.06	2.29	2.54	2.87	.023
02KC014-	INDIAN RIVER NEAR PEMBROKE	443.0	1969-82	14N	46.0	.94	1.00	1.26	1.48	1.71	2.01	2.25	2.51	2.85	.103
02LA007-	JOCK RIVER NEAR RICHMOND	553.0	1970-83	14N	120.0	.97	1.00	1.09	1.15	1.17	1.21	1.23	1.25	1.28	.220
02LA006-	KEMPTVILLE CK.NEAR KEMPTVILLE	409.0	1970-82*	13N	66.0	.97	1.00	1.13	1.22	1.30	1.40	1.47	1.54	1.63	.164
02EA018-	MAGNETAWAN R. AT MAPLE ISLAND	1850.0	1946-57	12N	135.0	.96	1.00	1.19	1.33	1.45	1.61	1.72	1.83	1.97	.017
02EA006-	MAGNETAWAN R.NEAR BURK*S FALL	653.0	1915-82*	07N	51.0	.94	1.00	1.25	1.46	1.67	1.93	2.13	2.34	2.61	.079
02ML005-	MOIRA RIVER NEAR DELORO	308.0	1966-82	17N	36.0	.95	1.00	1.19	1.35	1.49	1.67	1.81	1.95	2.14	.119
02EA005-	N. MAGNETAWAN R.NEAR BURK*S F	721.0	1915-82	07N	45.0	.95	1.00	1.24	1.42	1.57	1.78	1.93	2.08	2.29	.142
02EA010-	N.MAGNETAWAN R.ABOVE PICKR*L	149.0	1968-82	15N	33.0	.96	1.00	1.27	1.56	1.94	2.53	3.09	3.73	4.78	.207
02CF009-	NOLIN CREEK AT SUDBURY	21.5	1959-82*	24N	10.8	.95	1.00	1.24	1.46	1.67	1.98	2.21	2.47	2.83	.493
02KA003-	PERCH L. OUTLET NEAR CHALK R.	5.0	1967-82	16N	.5	.96	1.00	1.15	1.25	1.35	1.48	1.57	1.65	1.76	.075
02KA004-	PERCH L.INLET #1 NEAR CHALK R	.9	1973-82	10N	.1	.91	1.00	1.52	2.07	2.73	3.77	4.70	5.80	7.49	.114
02KA005-	PERCH L.INLET #2 NEAR CHALK R	3.4	1968-82	16N	.4	.96	1.00	1.17	1.29	1.41	1.55	1.66	1.75	1.88	.107
02KA006-	PERCH L.INLET #3 NEAR CHALK R	.8	1970-82	13N	.1	.95	1.00	1.23	1.41	1.57	1.78	1.94	2.10	2.31	.104
02KA007-	PERCH L.INLET #4 NEAR CHALK R	.2	1973-82	10N	.1	.92	1.00	1.40	1.82	2.32	3.11	3.81	4.62	5.98	.206
02CA002-	ROOT R. AT SAULT STE. MARIE	108.0	1971-83	13N	34.0	.94	1.00	1.34	1.73	2.11	2.74	3.29	3.91	4.87	.294
02ML004-	SKOOTAMATTA R.NEAR ACTINOLITE	712.0	1965-82	18N	78.0	.95	1.00	1.22	1.40	1.58	1.81	1.99	2.18	2.43	.110
02CF011-	VERMILLION R. NEAR VAL CARON	704.0	1971-82	12N	65.0	.94	1.00	1.32	1.63	1.96	2.45	2.85	3.31	3.97	.086
02CF007-	WHITSON RIVER AT CHELMSFORD	272.0	1962-82	21N	40.0	.95	1.00	1.19	1.32	1.45	1.62	1.74	1.85	2.08	.151
02HM004-	WILTON CREEK NEAR NAPANEE	112.0	1972-82	11N	29.0	.95	1.00	1.23	1.43	1.64	1.91	2.12	2.34	2.65	.256
02CE002-	AUX SABLES RIVER AT MASSEY	6800.0	1921-82	62R	118.0	.93	1.00	1.28	1.56	1.70	1.96	2.16	2.36	2.61	.088
02MF003-	BURNT RIVER NEAR BURNT RIVER	1270.0	1966-82	17R	120.0	.96	1.00	1.19	1.35	1.52	1.73	1.91	2.08	2.33	.092
02CF005-	JUNCTION CREEK AT SUDBURY	99.1	1959-82	24R	24.0	.94	1.00	1.23	1.42	1.59	1.81	1.98	2.15	2.38	.267
02CC004-	MISSISSAGI R. AT MISSISSAGI	9270.0	1921-82	30R	521.0	.93	1.00	1.31	1.61	1.93	2.39	2.77	3.18	3.77	.054
02HM001-	NAPANEE RIVER NEAR NAPANEE	777.0	1952-73	22R	64.0	.94	1.00	1.23	1.40	1.55	1.75	1.87	2.01	2.17	.084
02HM003-	SALMON R. NEAR SHANNONVILLE	391.0	1959-82	24R	77.0	.95	1.00	1.24	1.42	1.58	1.79	1.95	2.10	2.30	.087

TOTAL NUMBER OF STATIONS: 30 NATURAL: 24 REGULATED: 6

DATA FOR STATIONS IN REGION 2

STATION NUMBER	STATION NAME	AREA SQ.KM	DATA YEARS	TOT	Q2	RATIO TO INDEX FLOOD (Q2) FOR SELECTED RETURN PERIODS R=1.25	R=2.00	R=5.00	R=10.0	R=20.0	R=50.0	R=100	R=200	R=500	SPQ2
02LB008-	BEAR BROOK NEAR BOURGET	440.0	1949-82	27N	135.0	.91	1.00	1.38	1.71	2.03	2.45	2.78	3.12	3.53	.298
02LB006-	CASTOR RIVER AT RUSSELL	433.0	1948-82	35N	157.0	.94	1.00	1.29	1.52	1.74	2.04	2.27	2.50	2.82	.355
02LB012-	EAST BR. SCOTCH R. NEAR ST.IS	76.7	1970-83	14N	24.0	.96	1.00	1.29	1.63	2.07	2.82	3.53	4.41	5.83	.287
02MC001-	RAISIN R. NEAR WILLIAMSTOWN	404.0	1961-82	22N	93.0	.95	1.00	1.19	1.31	1.40	1.51	1.58	1.63	1.71	.238
02LB009-	S. NATION R. AT CHESTERVILLE	1050.0	1955-82*	28N	204.0	.94	1.00	1.17	1.27	1.36	1.45	1.51	1.57	1.62	.286
02LB007-	S. NATION R. AT SPENCERVILLE	246.0	1948-82	35N	54.0	.92	1.00	1.30	1.55	1.76	2.05	2.25	2.45	2.72	.225
02LB005-	S. NATION R. NEAR PLANTAGENET	3810.0	1946-82*	37N	784.0	.95	1.00	1.18	1.28	1.36	1.44	1.49	1.53	1.58	.220

TOTAL NUMBER OF STATIONS: 7 NATURAL: 7 REGULATED: 0

* - DENOTES STATION HAVING MINOR REGULATION (CLASSIFIED AS NATURAL FOR CALCULATIONS)

TABLE : 5.1.3

DATA FOR STATIONS IN REGION 3

STATION NUMBER	STATION NAME	AREA SQ.KM	DATA YEARS	TOT	Q2	RATIO TO INDEX FLOOD (Q2) FOR SELECTED RETURN PERIODS R=1.25	R=2.00	R=5.00	R=10.0	R=20.0	R=50.0	R=100	R=200	R=500	SPQ2
02FB010-	BIGHEAD RIVER NEAR MEAFORD	293.0	1958-82*	25N	76.0	.93	1.00	1.37	1.73	2.14	2.76	3.29	3.88	4.77	.237
02ED102-	BOYNE R. AT EARL ROWE PARK	211.0	1969-82	14N	51.3	.91	1.00	1.44	1.83	2.23	2.78	3.23	3.69	4.37	.232
02FC011-	CARRICK CREEK NEAR CARLSRUHE	163.0	1954-82	29N	36.0	.92	1.00	1.35	1.66	1.94	2.33	2.63	2.93	3.34	.217
02ED005-	MAD RIVER NEAR GLENCAIRN	295.0	1964-82*	19N	59.3	.92	1.00	1.33	1.62	1.89	2.25	2.55	2.84	3.24	.198
02ED003-	NOTTAWASAGA RIVER NEAR BAXTER	1180.0	1949-82	34N	136.0	.92	1.00	1.36	1.69	2.01	2.46	2.81	3.19	3.70	.213
02ED103-	PINE RIVER NEAR EVERETT	195.0	1969-82	14N	25.0	.92	1.00	1.42	1.83	2.20	2.97	3.56	4.22	5.19	.174
02FC004-	ROCKY SAUGEEN R.NEAR TRAVERS.	249.0	1916-40	26N	19.0	.94	1.00	1.29	1.51	1.73	2.01	2.22	2.45	2.73	.092
02FA001-	SAUBLE RIVER AT SAUBLE FALLS	927.0	1958-82	25N	128.0	.94	1.00	1.25	1.45	1.63	1.88	2.06	2.24	2.49	.140
02FC001-	SAUGEEN RIVER NEAR PORT ELGIN	3960.0	1916-82	67N	589.0	.93	1.00	1.25	1.46	1.65	1.88	2.05	2.22	2.44	.152
02FC002-	SAUGEENRIVER NEAR WALKERTON	2150.0	1916-82	67N	340.0	.93	1.00	1.31	1.57	1.83	2.17	2.45	2.73	3.13	.155
02FB007-	SYDENHAM R. NEAR OWEN SOUND	181.0	1946-82	37N	39.0	.93	1.00	1.34	1.64	1.91	2.26	2.54	2.82	3.19	.214
02FC015-	TEESWATER RIVER NEAR PAISLEY	663.0	1972-82	11N	103.2	.95	1.00	1.19	1.33	1.46	1.63	1.75	1.86	2.02	.150
02ED100-	BEETON CREEK NEAR TOTTENHAM	86.0	1969-82	14R	14.0	.93	1.00	1.36	1.69	2.06	2.60	3.04	3.54	4.25	.154
02FC013-	NORTH SAUGEEN R. NEAR PAISLEY	262.0	1972-82	11R	40.0	.95	1.00	1.22	1.41	1.61	1.88	2.09	2.31	2.62	.150
02FC012-	S. SAUGEEN R. NEAR HANOVER	635.0	1972-82	11R	178.0	.95	1.00	1.23	1.42	1.61	1.85	2.03	2.21	2.46	.280

TOTAL NUMBER OF STATIONS= 15 NATURAL= 12 REGULATED= 3

* - DENOTES STATION HAVING MINOR REGULATION (CLASSIFIED AS NATURAL FOR CALCULATIONS)

TABLE # 5.1.4

DATA FOR STATIONS IN REGION 4

STATION NUMBER	STATION NAME	AREA SQ.KM	DATA YEARS	TOT	Q2	RATIO TO INDEX FLOOD (Q2) FOR SELECTED RETURN PERIODS R=1.25	R=2.00	R=5.00	R=10.0	R=20.0	R=50.0	R=100	R=200	R=500	SPQ2
02GA030-	ALDER CREEK NEAR NEW DUNDEE	49.7	1966-82*	17N	11.0	.90	1.00	1.44	1.84	2.24	2.80	3.25	3.71	4.37	.212
02GA031-	BLUE SPRINGS CK.NEAR EDEN MIL	44.5	1969-82*	14N	5.4	.93	1.00	1.28	1.48	1.65	1.85	1.99	2.12	2.30	.128
02FE010-	BOYLE DRAIN NEAR ATWOOD	197.0	1968-79	12N	60.0	.93	1.00	1.30	1.57	1.83	2.18	2.46	2.76	3.16	.302
02GA036-	CANAGAGIGUE CK. NEAR FLORADAL	17.9	1971-83	13N	16.0	.91	1.00	1.34	1.60	1.83	2.14	2.36	2.57	2.85	.922
02GA039-	CONESTOGO RIVER ABOVE DRAYTON	272.0	1973-82	10N	223.0	.93	1.00	1.31	1.56	1.81	2.13	2.38	2.63	2.97	.819
02GA017-	CONESTOGO RIVER AT DRAYTON	324.0	1951-72	22N	157.0	.94	1.00	1.22	1.37	1.49	1.63	1.72	1.80	1.90	.492
02GA035-	E.CANAGAGIGUE CK.NEAR FLO*DAL	27.7	1971-83	13N	15.7	.92	1.00	1.34	1.62	1.89	2.25	2.53	2.81	3.19	.568
02GB007-	FAIRCHILD CREEK NEAR BRANTFOR	360.0	1965-82	18N	50.0	.95	1.00	1.21	1.36	1.48	1.63	1.73	1.82	1.94	.146
02GD010-	FISH CREEK NEAR PROSPECT HILL	150.0	1946-82	37N	61.0	.92	1.00	1.36	1.67	1.97	2.37	2.67	2.99	3.42	.408
02GB001-	GRAND R. AT BRANTFORD(NATURAL	5210.0	1948-79	32N	982.0	.91	1.00	1.32	1.57	1.80	2.08	2.28	2.49	2.75	.195
02GA003-	GRAND R. AT GALT(1914-79)PT.N	3520.0	1914-79	66N	766.0	.93	1.00	1.33	1.58	1.82	2.14	2.37	2.60	2.92	.218
02GA016-	GRAND R. BELOW SHAND DAM(NAT)	800.0	1948-79	32N	269.0	.92	1.00	1.36	1.67	1.96	2.34	2.64	2.93	3.33	.333
02GA001-	GRAND RIVER AT BELLWOOD	760.0	1913-23	11N	215.0	.93	1.00	1.32	1.57	1.80	2.09	2.32	2.53	2.81	.274
02GB002-	GRAND RIVER AT YORK	5910.0	1914-23*	10N	862.0	.96	1.00	1.15	1.28	1.40	1.54	1.65	1.77	1.91	.143
02GB006-	HORNER CREEK NEAR PRINCETON	150.0	1954-82*	29N	39.0	.94	1.00	1.31	1.55	1.80	2.13	2.38	2.64	2.99	.248
02GB009-	KENNY CREEK NEAR BURFORD	91.9	1962-82	21N	40.0	.91	1.00	1.40	1.75	2.12	2.62	3.02	3.44	4.04	.098
02FE002-	MAITLAND RIVER BELOW WINGHAM	1530.0	1953-82*	30N	416.0	.93	1.00	1.32	1.56	1.78	2.06	2.26	2.46	2.72	.260
02FE004-	MAITLAND R. NEAR DONNYBROOK	1760.0	1946-82*	37N	473.0	.92	1.00	1.34	1.61	1.87	2.20	2.45	2.69	3.02	.272
02FE008-	MIDDLE MAITLAND R.NEAR BELW*D	648.0	1971-82	12N	189.0	.93	1.00	1.23	1.42	1.58	1.79	1.93	2.07	2.25	.300
02GB011-	MOUNT PLEASANT CK.NEAR BURTCH	29.0	1964-76	13N	6.0	.85	1.00	1.88	2.88	4.11	6.18	8.10	10.41	14.13	.178
02GD003-	N.THAMES R.BELOW FANSHAW DAM	1450.0	1916-44	29N	379.0	.93	1.00	1.25	1.43	1.58	1.76	1.88	2.00	2.16	.269
02GA038-	NITH RIVER ABOVE WITHBURG	326.0	1972-82	11N	221.0	.95	1.00	1.17	1.28	1.36	1.43	1.48	1.53	1.58	.706
02GA018-	NITH RIVER AT NEW HAMBURG	552.0	1951-82	32N	223.0	.93	1.00	1.31	1.56	1.77	2.05	2.25	2.45	2.72	.411
02GA010-	NITH RIVER NEAR CANNING	1030.0	1948-82	35N	259.0	.94	1.00	1.25	1.43	1.59	1.78	1.92	2.05	2.23	.256
02GA032-	O.A.C. FARM G. NO.5 AT GUELPH	2.5	1970-82	13N	3.2	.88	1.00	1.79	2.64	3.64	5.21	6.62	8.24	10.77	1.027
02GA037-	SCHNEIDER CREEK AT KITCHENER	25.1	1972-83	12N	18.2	.92	1.00	1.43	1.83	2.26	2.88	3.40	3.95	4.76	.688
02FE009-	S. MAITLAND R. AT SUMMERVILLE	376.0	1971-82	12N	116.0	.94	1.00	1.35	1.67	2.04	2.59	3.05	3.56	4.32	.292
02GA015-	SPEED R. BELOW GUELPH(1951-79	593.0	1951-79	29N	78.0	.91	1.00	1.41	1.74	2.09	2.55	2.90	3.27	3.78	.128
02GA040-	SPEED R. NEAR ARMSTRONG MILLS	167.0	1974-83*	10N	65.0	.92	1.00	1.36	1.66	1.96	2.35	2.65	2.96	3.38	.391
02GD012-	THAMES RIVER AT WOODSTOCK	254.0	1952-64	13N	64.0	.88	1.00	1.66	2.35	3.15	4.38	5.45	6.68	8.57	.224
02GD001-	THAMES RIVER NEAR EALING	1340.0	1916-66	51N	226.0	.91	1.00	1.42	1.78	2.12	2.59	2.95	3.33	3.85	.166
02GD019-	TROUT CREEK NEAR FAIRVIEW	36.0	1967-82	16N	21.2	.96	1.00	1.20	1.44	1.71	2.17	2.60	3.10	3.89	.554
02GD020-	WAUBUNO CREEK NEAR DORCHESTER	104.0	1966-82	17N	38.0	.93	1.00	1.29	1.51	1.73	2.03	2.20	2.48	2.66	.359
02GB008-	WHITEMANS CK. NEAR MT. VERNON	383.0	1962-82*	21N	57.0	.94	1.00	1.20	1.35	1.48	1.61	1.71	1.80	1.91	.155
02GD018-	AVON RIVER BELOW STRATFORD	144.0	1965-82	18R	60.0	.95	1.00	1.25	1.46	1.68	1.95	2.17	2.39	2.70	.410
02GD011-	CEDAR CREEK AT WOODSTOCK	93.2	1952-82	31R	28.0	.90	1.00	1.49	1.94	2.39	3.05	3.57	4.14	4.95	.279
02GA022-	GRAND RIVER AT WALDEMAR	655.0	1953-64	12R	169.0	.94	1.00	1.26	1.45	1.63	1.87	2.05	2.22	2.45	.254
02FE007-	LITTLE MAITLAND R.AT BLUEVALE	326.0	1968-82	15R	113.0	.93	1.00	1.37	1.68	1.99	2.41	2.73	3.07	3.54	.340
02GA033-	LITTERAL CREEK NEAR DUSTIC	64.8	1954-82	29R	15.0	.91	1.00	1.42	1.76	2.10	2.56	2.93	3.29	3.73	.221
02FE005-	MAITLAND RIVER ABOVE WINGHAM	528.0	1953-82	30R	175.0	.90	1.00	1.41	1.73	2.05	2.46	2.76	3.07	3.49	.335
02GB010-	MCKENZIE CREEK NEAR CALEDONIA	171.0	1962-82	21R	23.0	.94	1.00	1.24	1.41	1.57	1.74	1.87	1.97	2.12	.138
02GD008-	MEDWAY RIVER AT LONDON	200.0	1973-82	10R	96.0	.95	1.00	1.19	1.34	1.47	1.62	1.74	1.84	1.98	.496
02FE003-	MIDDLE MAITLAND R. NEAR LIST*	77.7	1953-79	27R	39.0	.93	1.00	1.33	1.58	1.80	2.09	2.29	2.49	2.75	.495
02GD004-	MIDDLE THAMES RIVER AT THAMES	306.0	1946-82	37R	106.0	.91	1.00	1.44	1.82	2.20	2.70	3.09	3.49	4.05	.337
02GD014-	NORTH THAMES R. NEAR MITCHELL	319.0	1955-82	28R	238.0	.93	1.00	1.31	1.55	1.79	2.10	2.34	2.58	2.90	.731
02GD015-	NORTH THAMES R.NEAR THORNDALE	1340.0	1954-82	29R	506.0	.93	1.00	1.20	1.33	1.43	1.53	1.60	1.66	1.73	.404
02GD005-	NORTH THAMES R. AT ST. MARY	1080.0	1948-82	35R	438.0	.93	1.00	1.26	1.44	1.58	1.74	1.85	1.95	2.07	.425

TOTAL NUMBER OF STATIONS: 47 NATURAL: 34 REGULATED: 13

* - DENOTES STATION HAVING MINOR REGULATION (CLASSIFIED AS NATURAL FOR CALCULATIONS)

TABLE : 5.1.5

DATA FOR STATIONS IN REGION 5

STATION NUMBER	STATION NAME	AREA SQ.KM	DATA YEARS	TOT	Q2	RATIO TO INDEX FLOOD (Q2) FOR SELECTED RETURN PERIODS R=1.25	R=2.00	R=5.00	R=10.0	R=20.0	R=50.0	R=100	R=200	R=500	SPQ2
02FF002-	AUSABLE RIVER NEAR SPRINGBANK	865.0	1948-82	35N	226.0	.93	1.00	1.32	1.56	1.81	2.13	2.38	2.62	2.96	.256
02FF007-	BAYFIELD RIVER NEAR VARNA	466.0	1967-82	16N	183.0	.94	1.00	1.24	1.43	1.60	1.84	2.01	2.19	2.42	.396
02GG004-	BEAR CREEK ABOVE WILKESPORT	609.0	1965-82	18N	105.0	.93	1.00	1.36	1.68	2.00	2.44	2.83	3.18	3.70	.167
02GG006-	BEAR CREEK NEAR PETROLIA	267.0	1967-82	16N	96.0	.92	1.00	1.39	1.72	2.05	2.50	2.85	3.21	3.71	.353
02GE005-	DINGMAN CREEK BELOW LAMBETH	146.0	1966-82	17N	37.0	.94	1.00	1.27	1.50	1.71	1.99	2.20	2.42	2.71	.255
02FF008-	PARKHILL CREEK ABOVE PARKHILL	110.0	1973-82	10N	34.0	.97	1.00	1.13	1.22	1.29	1.38	1.45	1.51	1.59	.319
02FD001-	PINE RIVER AT LURGAN	154.0	1974-83	10N	100.0	.92	1.00	1.37	1.66	1.95	2.33	2.61	2.89	3.28	.617
02GH002-	RUSCOM R. NEAR RUSCOM STATION	125.0	1972-83	12N	58.0	.93	1.00	1.29	1.51	1.74	2.03	2.25	2.47	2.75	.472
02FF004-	S. PARKHILL CK. NEAR PARKHILL	41.4	1966-82	17N	25.0	.94	1.00	1.21	1.38	1.51	1.69	1.82	1.93	2.09	.623
02FF006-	SHIPKA CREEK NEAR GRAND BEND	33.7	1957-69	13N	13.0	.88	1.00	1.63	2.23	2.88	3.83	4.61	5.47	6.74	.355
02GH001-	STURGEON CK. NEAR LEAMINGTON	14.2	1972-83	12N	19.0	.91	1.00	1.46	1.90	2.38	3.08	3.67	4.33	5.28	1.162
02GG005-	SYDENHAM RIVER AT STRATHROY	172.0	1967-82	16N	38.0	.95	1.00	1.31	1.62	1.96	2.45	2.88	3.35	4.05	.206
02GG002-	SYDENHAM RIVER NEAR ALVINSTON	730.0	1949-82	34N	121.0	.93	1.00	1.27	1.48	1.68	1.93	2.12	2.31	2.56	.166
02GG007-	SYDENHAM RIVER NEAR DRESDEN	1240.0	1967-82	16N	158.0	.95	1.00	1.24	1.47	1.71	2.06	2.34	2.66	3.11	.123
02GE002-	THAMES RIVER AT BYRON	3110.0	1955-82	28R	657.0	.95	1.00	1.18	1.29	1.36	1.45	1.50	1.54	1.59	.226
02GE003-	THAMES RIVER AT THAMESVILLE	4300.0	1955-82	28R	957.0	.94	1.00	1.21	1.38	1.48	1.62	1.71	1.80	1.90	.135
02GE006-	THAMES RIVER NEAR DUTTON	3760.0	1973-82	10R	876.0	.98	1.00	1.20	1.45	1.81	2.44	3.10	3.92	5.37	.142

TOTAL NUMBER OF STATIONS: 17 NATURAL: 14 REGULATED: 3

DATA FOR STATIONS IN REGION 6

STATION NUMBER	STATION NAME	AREA SQ.KM	DATA YEARS	TOT	Q2	RATIO TO INDEX FLOOD (Q2) FOR SELECTED RETURN PERIODS R=1.25	R=2.00	R=5.00	R=10.0	R=20.0	R=50.0	R=100	R=200	R=500	SPQ2
02GC011-	BIG CREEK NEAR KELVIN	142.0	1964-78*	15N	34.0	.91	1.00	1.39	1.71	2.02	2.44	2.75	3.07	3.52	.232
02GC007-	BIG CREEK NEAR WALSINGHAM	591.0	1956-82*	27N	53.0	.83	1.00	1.58	2.18	2.86	3.91	4.82	5.86	7.45	.077
02GC004-	BIG OTTER CREEK NEAR VIENNA	697.0	1955-75*	21N	75.0	.91	1.00	1.45	1.85	2.26	2.84	3.31	3.79	4.48	.103
02GC018-	CATFISH CREEK NEAR SPARTA	287.0	1965-82	18N	117.0	.95	1.00	1.20	1.35	1.50	1.69	1.81	1.95	2.12	.417
02GC015-	L. OTTER CK. NEAR STRAFFORVILL	104.0	1964-82*	19N	13.0	.93	1.00	1.30	1.58	1.84	2.19	2.47	2.76	3.15	.128
02GC012-	PATTERSON CREEK NEAR SIMCOE	51.3	1964-82*	19N	5.0	.92	1.00	1.39	1.73	2.07	2.55	2.91	3.30	3.84	.097
02GC016-	S. OTTER CK.NEAR PORT BURWELL	109.0	1965-77*	13N	18.0	.90	1.00	1.52	2.02	2.59	3.43	4.15	4.96	6.16	.149
02GC006-	BIG CREEK NEAR DELHI	363.0	1956-82	27R	41.0	.89	1.00	1.55	2.08	2.65	3.48	4.18	4.93	6.05	.103
02GC017-	BIG OTTER CK.ABOVE OTTERVILLE	93.2	1965-82	18R	22.0	.92	1.00	1.28	1.48	1.65	1.86	2.01	2.14	2.32	.250
02GC010-	BIG OTTER CK. AT TILLSONBURG	342.0	1961-82	22R	67.0	.91	1.00	1.40	1.73	2.07	2.52	2.88	3.24	3.76	.192
02GC013-	DEDRICH CREEK NEAR PORT ROWAN	75.9	1964-82	19R	16.0	.89	1.00	1.46	1.83	2.19	2.66	3.01	3.36	3.84	.205
02GC002-	KETTLE CREEK AT ST. THOMAS	329.0	1967-82	16R	146.0	.95	1.00	1.28	1.51	1.74	2.07	2.33	2.59	2.97	.435
02GC008-	LYNN RIVER AT SIMCOE	134.0	1958-82	25R	20.0	.91	1.00	1.47	1.88	2.32	2.92	3.39	3.89	4.62	.143
02GC014-	YOUNG CREEK NEAR VITTORIA	65.8	1967-78	12R	7.0	.90	1.00	1.47	1.90	2.34	2.97	3.49	4.03	4.82	.099

TOTAL NUMBER OF STATIONS: 14 NATURAL: 7 REGULATED: 7

* - DENOTES STATION HAVING MINOR REGULATION (CLASSIFIED AS NATURAL FOR CALCULATIONS)

TABLE : 5.1.6

DATA FOR STATIONS IN REGION 7

STATION NUMBER	STATION NAME	AREA SQ.KM	DATA YEARS	TOT	Q2	RATIO TO INDEX FLOOD (Q2) FOR SELECTED RETURN PERIODS R=1.25	R=2.00	R=5.00	R=10.0	R=20.0	R=50.0	R=100	R=200	R=500	SPQ2
02HB012-	GRINDSTONE CK. NEAR ALDERSHOT	82.6	1972-82	11N	26.3	.94	1.00	1.25	1.42	1.57	1.75	1.88	1.99	2.13	.327
02HB010-	SPENCER CK.AT DUNDAS CROSSING	166.0	1961-70	10N	22.1	.93	1.00	1.29	1.50	1.69	1.92	2.10	2.26	2.48	.134
02HA006-	TWENTY MILE CK.AT BALLS FALLS	293.0	1957-82	26N	76.0	.93	1.00	1.27	1.48	1.66	1.88	2.05	2.20	2.42	.268
02HB011-	BRONTE CREEK NEAR ZIMMERMAN	235.0	1964-82	19R	24.6	.95	1.00	1.19	1.32	1.46	1.63	1.75	1.86	2.02	.103
02HB004-	EAST OAKVILLE CK. NEAR OMAGH	199.0	1957-82	25R	63.0	.93	1.00	1.32	1.58	1.82	2.14	2.38	2.62	2.94	.319
02HB005-	OAKVILLE CREEK AT MILTON	95.6	1959-82E	24R	18.3	.93	1.00	1.30	1.56	1.81	2.15	2.41	2.68	3.05	.186
02HB015-	SPENCER CREEK NEAR WESTOVER	63.5	1973-82E	10R	6.0	.94	1.00	1.25	1.45	1.63	1.87	2.05	2.23	2.46	.095
02HA007-	WELLAND R.BELOW CAISTOR CORNS	230.0	1958-82E	25R	51.0	.94	1.00	1.26	1.46	1.66	1.91	2.10	2.28	2.54	.220

TOTAL NUMBER OF STATIONS: 9 NATURAL: 3 REGULATED: 5

DATA FOR STATIONS IN REGION 8

STATION NUMBER	STATION NAME	AREA SQ.KM	DATA YEARS	TOT	Q2	RATIO TO INDEX FLOOD (Q2) FOR SELECTED RETURN PERIODS R=1.25	R=2.00	R=5.00	R=10.0	R=20.0	R=50.0	R=100	R=200	R=500	SPQ2
02HC027-	BLACK CREEK NEAR WESTON	59.0	1973-82	10N	55.0	.95	1.00	1.25	1.46	1.68	1.97	2.20	2.44	2.77	.938
02HD214-	BOWMANVILLE CK.(HAYDON TRIB.)	26.2	1967-78	12N	10.1	.90	1.00	1.53	2.09	2.73	3.73	4.60	5.60	7.15	.346
02HD211-	BOWMANVILLE CREEK NEAR ENFIEL	6.2	1969-78	10N	2.7	.92	1.00	1.38	1.71	2.07	2.58	2.99	3.42	4.06	.336
02HC023-	COLD CREEK NEAR BOLTON	62.2	1969-81	13N	16.0	.94	1.00	1.26	1.45	1.61	1.81	1.95	2.08	2.25	.260
02HB008-	CREDIT R. WEST BR. AT NORVAL	127.0	1963-82*	20N	17.5	.93	1.00	1.30	1.51	1.72	1.95	2.13	2.29	2.50	.138
02HB002-	CREDIT RIVER AT ERINDALE	795.0	1946-82*	37N	178.0	.89	1.00	1.47	1.89	2.33	2.96	3.46	4.00	4.77	.211
02HC019-	DUFFINS CREEK ABOVE PICKERING	93.5	1966-82	17N	40.0	.91	1.00	1.44	1.82	2.23	2.79	3.24	3.71	4.39	.408
02HC006-	DUFFINS CREEK AT PICKERING	249.0	1949-77*	23N	80.0	.92	1.00	1.31	1.67	2.07	2.68	3.13	3.62	4.28	.333
02HC009-	E. HUMBER R. NEAR PINE GROVE	197.0	1954-82	29N	32.0	.89	1.00	1.52	1.99	2.48	3.15	3.69	4.28	5.10	.154
02HC032-	EAST HUMBER R. AT KING CREEK	94.8	1966-82	17N	15.0	.94	1.00	1.22	1.37	1.50	1.66	1.76	1.86	1.99	.160
02HC002-	ETOBICOKE CR. NEAR SUMMERVILL	166.0	1946-61	16N	148.0	.92	1.00	1.30	1.48	1.63	1.79	1.90	2.00	2.11	.937
02HC017-	ETOBICOKE CREEK AT BRAMPTON	63.2	1967-82	16N	32.0	.95	1.00	1.26	1.43	1.73	2.04	2.30	2.56	2.94	.485
02HC030-	ETOBICOKE CREEK BELOW Q.E.W.	204.0	1967-82	16N	89.0	.94	1.00	1.32	1.61	1.92	2.36	2.72	3.10	3.66	.420
02HD002-	GANARASKA RIVER NEAR DALE	262.0	1954-75	22N	72.0	.88	1.00	1.64	2.30	3.06	4.23	5.26	6.42	8.21	.237
02HD003-	GANARASKA RIVER NEAR OSAGA	67.7	1960-82*	23N	20.0	.92	1.00	1.43	1.85	2.30	2.98	3.54	4.17	5.11	.270
02HC013-	HIGHLAND CREEK NEAR WEST HILL	88.1	1958-80	17N	33.0	.88	1.00	1.60	2.17	2.81	3.74	4.53	5.41	6.70	.385
02HC025-	HUMBER RIVER AT ELDER MILLS	303.0	1963-82	20N	33.0	.92	1.00	1.40	1.76	2.14	2.65	3.06	3.50	4.13	.125
02HC003-	HUMBER RIVER AT WESTON	800.0	1952-82*	31N	172.0	.89	1.00	1.56	2.09	2.66	3.50	4.21	4.96	6.10	.176
02HC012-	HUMBER RIVER NEAR CEDAR MILLS	160.0	1957-81*	25N	25.5	.89	1.00	1.57	2.11	2.68	3.53	4.22	4.99	6.10	.133
02HC029-	L. DON R. AT DON MILLS/LANS*G	130.0	1955-82	28N	43.0	.91	1.00	1.39	1.73	2.05	2.48	2.82	3.16	3.64	.330
02HC028-	L. ROUGE CK.NEAR LOCUST HILL	77.7	1964-82	19N	23.0	.94	1.00	1.19	1.32	1.43	1.55	1.64	1.72	1.82	.307
02HC018-	LYNDE CREEK NEAR WHITBY	106.0	1966-82	17N	29.0	.94	1.00	1.25	1.44	1.62	1.82	1.97	2.12	2.31	.277
02HC033-	MIMICO CREEK AT ISLINGTON	63.2	1966-80	17N	32.0	.93	1.00	1.28	1.52	1.74	2.05	2.28	2.52	2.84	.501
02HD004-	N.W. GANARASKA RIVER NEAR OSA	42.7	1960-80*	23N	17.5	.86	1.00	1.75	2.51	3.36	4.68	5.82	7.11	9.06	.355
02HD008-	OSHAWA CREEK AT OSHAWA	95.8	1960-82	23N	47.0	.89	1.00	1.54	2.06	2.62	3.44	4.13	4.88	5.98	.433
02HD010-	SHELTER VALLEY BK.NEAR GRAFTN	64.8	1966-82	17N	20.0	.91	1.00	1.46	1.93	2.44	3.22	3.89	4.63	5.75	.277
02HD223-	SOPER CK. NEAR STEPHENS GULCH	17.4	1966-77	12N	7.7	.93	1.00	1.46	2.00	2.67	3.83	4.92	6.22	8.35	.370
02HD224-	SOPER CK. TRIB. NEAR BOWMANVI	14.0	1968-77	10N	15.3	.93	1.00	1.41	1.92	2.55	3.67	4.75	6.07	8.24	.932
02HD007-	SOPER CREEK AT BOWMANVILLE	77.7	1960-82	23N	33.0	.89	1.00	1.60	2.17	2.80	3.76	4.56	5.46	6.79	.366
02HD221-	SOPER CREEK NEAR TYRONE	4.9	1968-77	10N	2.7	.87	1.00	1.62	2.17	2.74	3.54	4.19	4.87	5.85	.520
02HD233-	STALKER CREEK NEAR ORONO	21.0	1968-77	10N	8.8	.91	1.00	1.47	1.92	2.41	3.16	3.78	4.48	5.51	.370
02HC031-	W. HUMBER R. AT HIGHWAY NO.7	148.0	1966-82	17N	43.0	.94	1.00	1.27	1.51	1.76	2.11	2.39	2.68	3.11	.283
02HD232-	WILMOT CREEK NEAR KIRBY	27.2	1966-77	11N	4.9	.88	1.00	1.63	2.30	3.10	4.34	5.45	6.73	8.71	.160
02HD009-	WILMOT CREEK NEAR NEWCASTLE	82.6	1966-82	17N	25.0	.89	1.00	1.59	2.22	2.94	4.10	5.11	6.29	8.11	.247
02HD006-	BOWMANVILLE CK.AT BOWMANVILLE	82.9	1960-82	23R	33.0	.91	1.00	1.56	2.16	2.85	3.92	4.87	5.95	7.62	.343
02HB001-	CREDIT RIVER NEAR CATARACT	205.0	1925-82	58R	25.0	.92	1.00	1.36	1.68	1.99	2.41	2.74	3.08	3.55	.118
02HC024-	DON RIVER AT TODMORDEN	316.0	1972-82	11R	140.0	.97	1.00	1.10	1.14	1.18	1.21	1.23	1.24	1.26	.460

TOTAL NUMBER OF STATIONS: 37 NATURAL: 34 REGULATED: 3

* - DENOTES STATION HAVING MINOR REGULATION (CLASSIFIED AS NATURAL FOR CALCULATIONS)
E - DENOTES STATION HAVING HEAVY REGULATION (USED TO INCREASE DATA RANGE IN REGION)

TABLE : 5.1.7

DATA FOR STATIONS IN REGION 9

STATION NUMBER	STATION NAME	AREA SQ.KM	DATA YEARS	TOT	Q2	RATIO TO INDEX FLOOD (Q2) FOR SELECTED RETURN PERIODS R=1.25	R=2.00	R=5.00	R=10.0	R=20.0	R=50.0	R=100	R=200	R=500	SPG2
02EC011-	BEAVERTON RIVER NEAR BEAVERTO	252.0	1967-82	16N	56.0	.96	1.00	1.15	1.28	1.40	1.55	1.66	1.77	1.91	.198
02EC002-	BLACK RIVER NEAR WASHAGO	1520.0	1915-82	67N	132.0	.96	1.00	1.15	1.26	1.36	1.47	1.53	1.61	1.70	.090
02ED007-	COLDWATER RIVER AT COLDWATER	177.0	1966-82	17N	31.0	.95	1.00	1.21	1.38	1.51	1.70	1.84	1.97	2.14	.198
02EC009-	HOLLAND R. AT HOLLAND LANDING	181.0	1966-82	17N	36.0	.93	1.00	1.34	1.63	1.92	2.32	2.63	2.95	3.48	.192
02HJ001-	JACKSONS CK. AT PETERBOROUGH	110.0	1963-82	20N	21.0	.94	1.00	1.34	1.68	2.05	2.61	3.09	3.61	4.41	.181
02HJ003-	OUSE RIVER NEAR WESTWOOD	282.0	1971-82*	12N	44.0	.93	1.00	1.31	1.59	1.88	2.28	2.60	2.94	3.42	.153
02EC103-	PEFFERLAW BROOK NEAR UDORA	332.0	1970-82	13N	46.0	.92	1.00	1.34	1.63	1.92	2.30	2.60	2.91	3.33	.137
02EC010-	SCHOMBERB RIVER NEAR SCHOMBER	42.9	1967-82	16N	10.0	.95	1.00	1.23	1.41	1.56	1.77	1.92	2.08	2.28	.241
02EC101-	UXBRIDGE BROOK AT UXBRIDGE	24.3	1971-82*	12N	3.6	.91	1.00	1.43	1.82	2.22	2.77	3.22	3.69	4.36	.142
02ED009-	WILLOW CREEK ABOVE LITTLE LAK	95.0	1973-82*	11N	27.0	.96	1.00	1.17	1.28	1.38	1.50	1.56	1.64	1.73	.256
02ED010-	WILLOW CREEK AT MIDHURST	127.0	1973-82	10N	15.0	.96	1.00	1.14	1.23	1.32	1.42	1.49	1.55	1.63	.119
02EC012-	BLACK RIVER AT SUTTON	324.0	1970-82	13R	38.0	.94	1.00	1.34	1.72	2.16	2.87	3.51	4.25	5.42	.113

TOTAL NUMBER OF STATIONS: 12 NATURAL: 11 REGULATED: 1

DATA FOR STATIONS IN REGION 10

STATION NUMBER	STATION NAME	AREA SQ.KM	DATA YEARS	TOT	Q2	RATIO TO INDEX FLOOD (Q2) FOR SELECTED RETURN PERIODS R=1.25	R=2.00	R=5.00	R=10.0	R=20.0	R=50.0	R=100	R=200	R=500	SPG2
028F001-	BATCHAWANA R. NEAR BATCHAWANA	1190.0	1968-83	16N	219.0	.93	1.00	1.38	1.82	2.37	3.29	4.13	5.15	6.79	.167
028B002-	BLACK RIVER NEAR MARATHON	1980.0	1968-82	15N	210.0	.96	1.00	1.14	1.24	1.31	1.40	1.46	1.51	1.58	.188
02JC008-	BLANCHE RIVER ABOVE ENGLEHART	1780.0	1973-82	10N	190.0	.96	1.00	1.18	1.32	1.44	1.59	1.70	1.81	1.96	.188
02JE018-	FARR CREEK AT NORTH COBALT	52.3	1973-82	10N	7.0	.93	1.00	1.36	1.68	2.01	2.46	2.84	3.22	3.77	.102
028F002-	GOULAIS RIVER NEAR SEARCHMONT	1160.0	1968-82	15N	217.0	.94	1.00	1.27	1.50	1.72	2.01	2.23	2.46	2.77	.187
04JA002-	KABINAKAGAMI R. AT HWY NO.11	3780.0	1951-82	32N	234.0	.97	1.00	1.15	1.27	1.38	1.51	1.60	1.70	1.82	.062
028A003-	LITTLE PIC RIVER NEAR COLDWEL	1320.0	1973-82	10N	151.0	.92	1.00	1.35	1.63	1.90	2.26	2.52	2.79	3.16	.115
04LJ001-	MISSINAIBI RIVER AT MATTICE	8940.0	1920-82	63N	903.0	.95	1.00	1.20	1.35	1.48	1.63	1.74	1.84	1.97	.105
04JC002-	NAGAGAMI RIVER AT HWY. NO. 11	2410.0	1951-82	32N	123.0	.95	1.00	1.20	1.36	1.50	1.68	1.81	1.95	2.12	.052
04JC003-	SHEKAK RIVER AT HIGHWAY NO.11	3200.0	1951-82	32N	215.0	.95	1.00	1.18	1.33	1.47	1.64	1.77	1.90	2.07	.066
029A002-	STEEL RIVER NEAR TERRACE BAY	1190.0	1970-82	13N	79.0	.95	1.00	1.14	1.23	1.29	1.35	1.39	1.43	1.47	.069
04LD001-	GROUNDHOG RIVER AT FAUQUIER	11900.0	1921-82	62R	965.0	.95	1.00	1.23	1.40	1.56	1.75	1.89	2.03	2.22	.082
04LF001-	KAPUSKASING R. AT KAPUSKASING	6760.0	1919-82	64R	516.0	.95	1.00	1.19	1.34	1.47	1.62	1.72	1.83	1.95	.378

TOTAL NUMBER OF STATIONS: 13 NATURAL: 11 REGULATED: 2

* - DENOTES STATION HAVING MINOR REGULATION (CLASSIFIED AS NATURAL FOR CALCULATIONS)

TABLE : 5.1.8

DATA FOR STATIONS IN REGION 11

STATION NUMBER	STATION NAME	AREA SQ.KM	DATA YEARS	TOT	Q2	RATIO TO INDEX FLOOD (Q2) FOR SELECTED RETURN PERIODS R=1.25	R=2.00	R=5.00	R=10.0	R=20.0	R=50.0	R=100	R=200	R=500	SPQ2
04DB002-	ASHEWEIG R. ABOVE LONG DOG L.	3240.0	1968-77	10N	137.0	.94	1.00	1.27	1.49	1.68	1.94	2.13	2.33	2.58	.042
04DB001-	ASHEWEIG R. AT STRAIGHT LAKE	7950.0	1967-80	14N	293.0	.93	1.00	1.28	1.50	1.71	1.99	2.20	2.41	2.69	.037
04FB001-	ATTAWAPISKAT R. BELOW ATTAWAP	24200.0	1966-82	17N	520.0	.95	1.00	1.22	1.38	1.51	1.67	1.78	1.89	2.03	.038
04GA002-	CAT RIVER BELOW WESLEYAN LAKE	5390.0	1971-83	13N	84.0	.92	1.00	1.44	1.90	2.45	3.34	4.13	5.06	6.51	.014
05QE008-	CEDAR R. BELOW WABASKANG LAKE	1690.0	1970-82	13N	25.0	.90	1.00	1.56	2.09	2.69	3.58	4.34	5.19	6.46	.014
05QA001-	ENGLISH R. NEAR SIOUX LOOKOUT	13900.0	1922-81	60N	291.0	.92	1.00	1.37	1.68	2.00	2.42	2.74	3.09	3.55	.021
05QA002-	ENGLISH RIVER AT UMFREVILLE	6230.0	1922-82	61N	160.0	.91	1.00	1.40	1.75	2.10	2.59	2.97	3.37	3.93	.025
04CE002-	FAWN R. BELOW BIG TROUT LAKE	4350.0	1968-82	15N	66.0	.95	1.00	1.21	1.36	1.49	1.64	1.75	1.85	1.98	.015
05PC016-	LA VALLEE RIVER NEAR DEVLIN	243.0	1960-82	23N	32.0	.92	1.00	1.33	1.60	1.86	2.21	2.47	2.74	3.11	.132
04JF001-	LITTLE CURRENT RIVER AT PERCY	5360.0	1959-83	15N	185.0	.93	1.00	1.31	1.60	1.90	2.32	2.66	3.02	3.54	.033
05QA004-	MARCHINGTON RIVER AT MCDOUGAL	4450.0	1962-82	21N	113.0	.93	1.00	1.40	1.80	2.21	2.82	3.33	3.89	4.71	.024
02AB016-	MCINTYRE RIVER AT THUNDER BAY	145.0	1972-82*	11N	28.0	.90	1.00	1.51	1.98	2.47	3.18	3.76	4.40	5.30	.180
02AB014-	N. CURRENT R. NEAR THUNDER BA	112.0	1972-83	12N	22.0	.92	1.00	1.38	1.76	2.18	2.79	3.32	3.88	4.74	.188
05PA006-	NAMAKAN R.AT O+LT OF LAC LA C	13400.0	1923-82	60N	324.0	.93	1.00	1.28	1.50	1.69	1.92	2.09	2.25	2.46	.024
02AB008-	NEEBING RIVER NEAR THUNDER BA	187.0	1954-82	29N	32.0	.91	1.00	1.45	1.84	2.26	2.83	3.28	3.76	4.40	.166
05PD022-	NW TRIB.TO L. 239 NEAR KENORA	.7	1971-82	12N	.2	.91	1.00	1.46	1.90	2.39	3.10	3.70	4.35	5.33	.216
04GB004-	OGOKI RIVER ABOVE WHITECLAY L	11200.0	1972-83	12N	241.0	.92	1.00	1.34	1.70	2.09	2.67	3.16	3.71	4.53	.020
04FA001-	OTOSKWIN RIVER BELOW BADESDAW	9010.0	1970-82*	13N	308.0	.93	1.00	1.33	1.64	1.96	2.41	2.78	3.18	3.74	.033
02AA001-	PIGEON RIVER AT MIDDLE FALLS	1550.0	1924-82	59N	143.0	.93	1.00	1.31	1.55	1.79	2.08	2.31	2.53	2.83	.093
04FA003-	PINEIMUTA RIVER AT EYES LAKE	4900.0	1967-82	16N	251.0	.95	1.00	1.19	1.32	1.44	1.59	1.70	1.80	1.94	.052
05PC011-	PINEWOOD RIVER NEAR PINEWOOD	461.0	1952-82	31N	39.0	.89	1.00	1.57	2.16	2.82	3.84	4.73	5.76	7.38	.076
04DA001-	PIPESTONE RIVER AT KARL LAKE	5960.0	1967-80	14N	265.0	.93	1.00	1.34	1.67	2.05	2.60	3.07	3.59	4.37	.042
04CA003-	ROSEBERRY R.ABOVE ROSEBERRY L	619.0	1968-80	13N	33.0	.94	1.00	1.22	1.41	1.60	1.84	2.03	2.22	2.48	.054
04CD002-	SACHIGO R.BELOW O+LT OF SAC.L	4270.0	1973-82	10N	71.0	.94	1.00	1.28	1.51	1.73	2.01	2.22	2.44	2.73	.017
05QE009-	STURGEON R.AT O+LT OF SALV. L	1530.0	1965-82	18N	44.0	.93	1.00	1.37	1.75	2.10	2.87	3.48	4.18	5.25	.027
05PC010-	STURGEON RIVER NEAR BARWICK	168.0	1952-83	32N	23.0	.92	1.00	1.39	1.72	2.04	2.47	2.81	3.16	3.65	.132
05QC003-	TROUTLAKE R. BELOW BIG FALLS	2370.0	1970-82	13N	49.0	.94	1.00	1.31	1.59	1.89	2.32	2.67	3.05	3.59	.020
05PB014-	TURTLE RIVER NEAR MINE CENTRE	4870.0	1921-82	62N	128.0	.92	1.00	1.34	1.62	1.88	2.23	2.49	2.75	3.11	.026
04CB001-	WINDIGO R. ABOVE MUSKRAT DAM	10800.0	1968-80	13N	227.0	.95	1.00	1.19	1.32	1.44	1.58	1.69	1.79	1.91	.021
04DA002-	WINISK R. AT KANUCHUAN RAPIDS	19000.0	1968-77	10N	520.0	.95	1.00	1.26	1.45	1.63	1.86	2.03	2.20	2.43	.027
05PA012-	BASSWOOD RIVER NEAR WINTON	4510.0	1930-82	53R	185.0	.93	1.00	1.27	1.49	1.68	1.93	2.12	2.30	2.[illegible]	.037

TOTAL NUMBER OF STATIONS: 31 NATURAL: 30 REGULATED: 1

DATA FOR STATIONS IN REGION 12

STATION NUMBER	STATION NAME	AREA SQ.KM	DATA YEARS	TOT	Q2	RATIO TO INDEX FLOOD (Q2) FOR SELECTED RETURN PERIODS R=1.25	R=2.00	R=5.00	R=10.0	R=20.0	R=50.0	R=100	R=200	R=500	SPQ2
04FC001-	ATTAWAPISKAT RIVER BELOW MUKE	36000.0	1969-82	14N	1616.0	.93	1.00	1.38	1.87	2.52	3.70	4.87	6.33	8.82	.040
04EA001-	EKWAN R.BELOW N. WASHAGAMI R.	10400.0	1968-82	15N	780.0	.94	1.00	1.30	1.54	1.77	2.08	2.31	2.54	2.86	.075
04KA001-	KWATABOAHEGAN R. NEAR THE MTH	4250.0	1973-82	10N	485.0	.92	1.00	1.42	1.82	2.24	2.88	3.41	3.99	4.83	.103
04LM001-	MISSINAIBI R. BELOW WABOOSE	22900.0	1973-82	10N	2264.0	.96	1.00	1.11	1.17	1.21	1.27	1.30	1.32	1.35	.102
04MF001-	NORTH FRENCH R.NEAR THE MOUTH	6680.0	1967-82	16N	744.0	.95	1.00	1.13	1.19	1.23	1.27	1.29	1.31	1.33	.121
04CD001-	SACHIGO RIVER BELOW BEAVESTON	21100.0	1967-77	11N	682.0	.91	1.00	1.42	1.85	2.35	3.15	3.84	4.63	5.86	.030
04DC002-	SHAMATTAWA R.AT O+LT OF SH.L.	4710.0	1968-82	15N	315.0	.94	1.00	1.22	1.38	1.52	1.68	1.80	1.90	2.05	.070
04DC001-	WINISK RIVER BELOW ASHEWEIG R	50000.0	1966-81	15N	1686.0	.96	1.00	1.19	1.32	1.44	1.58	1.68	1.77	1.90	.032
04LG002-	MOOSE RIVER AT MOOSE RIVER	60100.0	1963-82	20R	5624.0	.96	1.00	1.15	1.28	1.40	1.57	1.69	1.81	1.98	.091

TOTAL NUMBER OF STATIONS: 9 NATURAL: 8 REGULATED: 1

* - DENOTES STATION HAVING MINOR REGULATION (CLASSIFIED AS NATURAL FOR CALCULATIONS)

TABLE : 5.1.9

STATION PARAMETER STATISTICS FOR REGION 1

---NOTE--- THE FOLLOWING STATISTICS DO NOT INCLUDE DATA WHICH ARE LESS THAN 10 YEARS

TOTAL NUMBER OF STATIONS USED IN CALCULATIONS : 30 NATURAL: 24 REGULATED: 6

RETURN PERIOD	DISCHARGE RATIO (NATURAL) MAX	MIN	MED	MEAN	STD	CV	DISCHARGE RATIO (REGULATED) MAX	MIN	MED	MEAN	STD	CV	DISCHARGE RATIO (ALL DATA) MAX	MIN	MED	MEAN	STD	CV
1.25	.97	.91	.95	.95	.01	.02	.96	.93	.94	.94	.01	.01	.97	.91	.95	.95	.01	.01
2	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00
5	1.52	1.09	1.24	1.25	.09	.07	1.31	1.19	1.24	1.25	.04	.04	1.52	1.09	1.24	1.25	.08	.07
10	2.07	1.15	1.45	1.46	.20	.14	1.61	1.35	1.42	1.45	.09	.07	2.07	1.15	1.43	1.46	.18	.13
20	2.73	1.17	1.65	1.69	.34	.21	1.93	1.52	1.59	1.65	.15	.10	2.73	1.17	1.62	1.68	.31	.19
50	3.77	1.21	1.90	2.00	.58	.30	2.39	1.73	1.80	1.90	.25	.14	3.77	1.21	1.86	1.98	.53	.28
100	4.70	1.23	2.11	2.26	.79	.38	2.77	1.87	1.97	2.11	.34	.17	4.70	1.23	2.04	2.23	.72	.35
200	5.80	1.25	2.31	2.54	1.05	.46	3.18	2.01	2.12	2.31	.44	.21	5.80	1.25	2.23	2.50	.96	.43
500	7.49	1.28	2.57	2.95	1.47	.57	3.77	2.17	2.35	2.59	.59	.25	7.49	1.28	2.48	2.88	1.34	.54

STANDARD ERRORS OF ESTIMATE AND CONFIDENCE INTERVAL FOR REGIONAL RATIOS

RETURN PERIOD IN YEARS	NATURAL DATA ONLY: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL	RELATIVE STANDARD ERROR OF ESTIMATE	REGULATED DATA ONLY: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL	RELATIVE STANDARD ERROR OF ESTIMATE	ALL DATA INCLUDED: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL	RELATIVE STANDARD ERROR OF ESTIMATE
1.25	.95	.94 , .96	.003	.94	.93 , .95	.005	.95	.94 , .95	.003
2	1.00	1.00 , 1.00	0.000	1.00	1.00 , 1.00	0.000	1.00	1.00 , 1.00	0.000
5	1.24	1.20 , 1.28	.015	1.24	1.19 , 1.29	.014	1.24	1.21 , 1.27	.012
10	1.45	1.36 , 1.53	.028	1.42	1.35 , 1.52	.027	1.43	1.36 , 1.49	.023
20	1.65	1.50 , 1.80	.042	1.59	1.50 , 1.70	.029	1.62	1.50 , 1.73	.035
50	1.90	1.66 , 2.15	.062	1.80	1.73 , 2.09	.056	1.86	1.66 , 2.06	.052
100	2.11	1.76 , 2.45	.077	1.97	1.87 , 2.36	.071	2.04	1.77 , 2.31	.065
200	2.31	1.85 , 2.76	.093	2.12	2.01 , 2.63	.085	2.23	1.86 , 2.59	.079
500	2.57	1.93 , 3.20	.117	2.35	2.17 , 3.04	.103	2.48	1.97 , 2.98	.099

STATISTICS OF STATION DATA YEARS USED FOR SINGLE STATION ANALYSES

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
67.00	10.00	13.50	19.04	15.34	.81	62.00	17.00	24.00	29.83	16.30	.55	67.00	10.00	15.50	21.20	15.86	.75

EXPECTED PROBABILITY COMPUTATIONS FOR REGIONAL RATIOS (ALL DATA)

RETURN PERIOD	EXCEEDANCE PROBABILITY	EXPECTED PROBABILITY
3.3	.300	.308 [3.2]
10.0	.100	.113 [8.9]
20.0	.050	.063 [16.0]
100.0	.010	.018 [57.1]
200.0	.005	.013 [79.8]
1000.0	.001	.003 [288.8]

[288.8] - DENOTES ASSOCIATED RETURN PERIOD

STATION PARAMETER STATISTICS FOR REGION 2

---NOTE--- THE FOLLOWING STATISTICS DO NOT INCLUDE DATA WHICH ARE LESS THAN 10 YEARS

TOTAL NUMBER OF STATIONS USED IN CALCULATIONS : 7 NATURAL: 7 REGULATED: 0

RETURN PERIOD	DISCHARGE RATIO (NATURAL) MAX	MIN	MED	MEAN	STD	CV	DISCHARGE RATIO (REGULATED) MAX	MIN	MED	MEAN	STD	CV	DISCHARGE RATIO (ALL DATA) MAX	MIN	MED	MEAN	STD	CV
1.25	.96	.91	.94	.94	.02	.02							.96	.91	.94	.94	.02	.02
2	1.00	1.00	1.00	1.00	0.00	0.00							1.00	1.00	1.00	1.00	0.00	0.00
5	1.38	1.17	1.29	1.26	.08	.06							1.38	1.17	1.29	1.26	.08	.06
10	1.71	1.27	1.52	1.47	.18	.12							1.71	1.27	1.52	1.47	.18	.12
20	2.07	1.36	1.74	1.67	.31	.18							2.07	1.36	1.74	1.67	.31	.18
50	2.82	1.44	2.04	1.97	.54	.26							2.82	1.44	2.04	1.97	.54	.26
100	3.53	1.49	2.25	2.20	.76	.34							3.53	1.49	2.25	2.20	.76	.34
200	4.41	1.53	2.45	2.46	1.05	.43							4.41	1.53	2.45	2.46	1.05	.43
500	5.83	1.58	2.72	2.84	1.52	.56							5.83	1.58	2.72	2.84	1.52	.56

STANDARD ERRORS OF ESTIMATE AND CONFIDENCE INTERVAL FOR REGIONAL RATIOS

RETURN PERIOD IN YEARS	NATURAL DATA ONLY: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL		RELATIVE STANDARD ERROR OF ESTIMATE	REGULATED DATA ONLY: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL	RELATIVE STANDARD ERROR OF ESTIMATE	ALL DATA INCLUDED: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL		RELATIVE STANDARD ERROR OF ESTIMATE
1.25	.94	.93	.96	.007				.94	.93	.96	.007
2	1.00	1.00	1.00	0.000				1.00	1.00	1.00	0.000
5	1.29	1.21	1.36	.023				1.29	1.21	1.36	.023
10	1.52	1.34	1.70	.045				1.52	1.34	1.70	.045
20	1.74	1.44	2.05	.067				1.74	1.44	2.05	.067
50	2.04	1.50	2.58	.100				2.04	1.50	2.58	.100
100	2.25	1.49	3.01	.129				2.25	1.49	3.01	.129
200	2.45	1.53	3.50	.162				2.45	1.53	3.50	.162
500	2.72	1.58	4.24	.212				2.72	1.58	4.24	.212

STATISTICS OF STATION DATA YEARS USED FOR SINGLE STATION ANALYSES

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
37.00	14.00	28.00	28.29	8.28	.29							37.00	14.00	28.00	28.29	8.28	.29

EXPECTED PROBABILITY COMPUTATIONS FOR REGIONAL RATIOS (ALL DATA)

RETURN PERIOD	EXCEEDANCE PROBABILITY	EXPECTED PROBABILITY
3.3	.300	.306 [3.3]
10.0	.100	.109 [9.2]
20.0	.050	.059 [16.9]
100.0	.010	.015 [65.0]
200.0	.005	.010 [96.3]
1000.0	.001	.003 [388.4]

[388.4] - DENOTES ASSOCIATED RETURN PERIOD

TABLE : 5.1.11

STATION PARAMETER STATISTICS FOR REGION 3

---NOTE--- THE FOLLOWING STATISTICS DO NOT INCLUDE DATA WHICH ARE LESS THAN 10 YEARS

TOTAL NUMBER OF STATIONS USED IN CALCULATIONS : 15 NATURAL: 12 REGULATED: 3

RETURN PERIOD	DISCHARGE RATIO (NATURAL) MAX	MIN	MED	MEAN	STD	CV	DISCHARGE RATIO (REGULATED) MAX	MIN	MED	MEAN	STD	CV	DISCHARGE RATIO (ALL DATA) MAX	MIN	MED	MEAN	STD	CV
1.25	.95	.91	.93	.93	.01	.01	.95	.93	.95	.94	.01	.01	.95	.91	.93	.93	.01	.01
2	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00
5	1.44	1.19	1.34	1.33	.07	.05	1.36	1.22	1.23	1.27	.08	.06	1.44	1.19	1.33	1.31	.07	.06
10	1.83	1.33	1.63	1.61	.15	.09	1.69	1.41	1.42	1.51	.16	.11	1.83	1.33	1.62	1.59	.15	.10
20	2.28	1.46	1.90	1.89	.25	.13	2.06	1.61	1.61	1.76	.26	.16	2.28	1.46	1.89	1.87	.25	.13
50	2.97	1.63	2.26	2.28	.41	.18	2.60	1.85	1.88	2.11	.42	.23	2.97	1.63	2.25	2.25	.40	.18
100	3.56	1.75	2.54	2.59	.55	.22	3.04	2.03	2.09	2.39	.57	.27	3.56	1.75	2.54	2.55	.54	.21
200	4.22	1.86	2.83	2.92	.71	.25	3.54	2.21	2.31	2.69	.74	.32	4.22	1.86	2.82	2.87	.72	.25
500	5.19	2.02	3.22	3.39	.97	.30	4.25	2.46	2.63	3.11	.99	.38	5.19	2.02	3.19	3.33	.95	.30

STANDARD ERRORS OF ESTIMATE AND CONFIDENCE INTERVAL FOR REGIONAL RATIOS

RETURN PERIOD IN YEARS	NATURAL DATA ONLY: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL		RELATIVE STANDARD ERROR OF ESTIMATE	REGULATED DATA ONLY: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL		RELATIVE STANDARD ERROR OF ESTIMATE	ALL DATA INCLUDED: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL		RELATIVE STANDARD ERROR OF ESTIMATE
1.25	.93	.92	.94	.004	.95	.93	.95	.008	.93	.92	.94	.006
2	1.00	1.00	1.00	0.000	1.00	1.00	1.00	0.000	1.00	1.00	1.00	0.000
5	1.34	1.29	1.39	.016	1.23	1.22	1.36	.036	1.33	1.29	1.38	.014
10	1.63	1.52	1.73	.027	1.42	1.41	1.69	.065	1.62	1.53	1.70	.025
20	1.90	1.73	2.06	.038	1.61	1.61	2.06	.094	1.89	1.75	2.03	.034
50	2.26	1.99	2.53	.052	1.88	1.85	2.60	.131	2.25	2.02	2.48	.046
100	2.54	2.17	2.91	.063	2.09	2.03	3.04	.157	2.54	2.23	2.84	.055
200	2.83	2.35	3.30	.073	2.31	2.21	3.54	.184	2.82	2.42	3.22	.064
500	3.22	2.57	3.86	.087	2.63	2.46	4.25	.218	3.19	2.65	3.73	.076

STATISTICS OF STATION DATA YEARS USED FOR SINGLE STATION ANALYSES

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
67.00	11.00	25.50	30.67	18.73	.61	14.00	11.00	11.00	12.00	1.73	.14	67.00	11.00	25.00	26.93	18.32	.68

EXPECTED PROBABILITY COMPUTATIONS FOR REGIONAL RATIOS (ALL DATA)

RETURN PERIOD	EXCEEDANCE PROBABILITY	EXPECTED PROBABILITY	
3.3	.300	.307	[3.3]
10.0	.100	.110	[9.1]
20.0	.050	.060	[16.7]
100.0	.010	.016	[63.7]
200.0	.005	.011	[93.5]
1000.0	.001	.003	[370.5]

[370.5] - DENOTES ASSOCIATED RETURN PERIOD

TABLE : 5.1.12

STATION PARAMETER STATISTICS FOR REGION 4

---NOTE--- THE FOLLOWING STATISTICS DO NOT INCLUDE DATA WHICH ARE LESS THAN 10 YEARS

TOTAL NUMBER OF STATIONS USED IN CALCULATIONS : 47 NATURAL: 34 REGULATED: 13

RETURN PERIOD	DISCHARGE RATIO (NATURAL) MAX	MIN	MED	MEAN	STD	CV	DISCHARGE RATIO (REGULATED) MAX	MIN	MED	MEAN	STD	CV	DISCHARGE RATIO (ALL DATA) MAX	MIN	MED	MEAN	STD	CV
1.25	.96	.85	.93	.92	.02	.03	.95	.90	.93	.93	.02	.02	.96	.85	.93	.92	.02	.02
2	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00
5	1.88	1.15	1.32	1.35	.16	.12	1.49	1.19	1.31	1.32	.10	.07	1.88	1.15	1.32	1.34	.14	.11
10	2.88	1.28	1.57	1.55	.34	.22	1.34	1.33	1.55	1.58	.19	.13	2.88	1.28	1.57	1.63	.31	.20
20	4.11	1.36	1.82	1.96	.59	.32	2.39	1.43	2.79	1.82	.30	.17	4.11	1.36	1.80	1.92	.52	.29
50	6.18	1.43	2.14	2.40	.99	.46	3.85	1.53	2.09	2.14	.46	.22	6.18	1.43	2.13	2.33	.88	.41
100	8.10	1.48	2.38	2.75	1.28	.58	3.57	1.60	2.29	2.38	.59	.26	8.10	1.48	2.37	2.65	1.22	.51
200	10.41	1.53	2.63	3.13	1.64	.70	4.14	1.66	2.42	2.63	.74	.30	10.41	1.53	2.60	2.99	1.62	.62
500	14.13	1.58	2.98	3.69	2.57	.86	4.95	1.73	2.75	2.96	.95	.35	14.13	1.58	2.92	3.49	2.26	.77

STANDARD ERRORS OF ESTIMATE AND CONFIDENCE INTERVAL FOR REGIONAL RATIOS

RETURN PERIOD IN YEARS	NATURAL DATA ONLY: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL		RELATIVE STANDARD ERROR OF ESTIMATE	REGULATED DATA ONLY: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL		RELATIVE STANDARD ERROR OF ESTIMATE	ALL DATA INCLUDED: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL		RELATIVE STANDARD ERROR OF ESTIMATE
1.25	.93	.92	.94	.004	.93	.92	.94	.005	.93	.92	.94	.004
2	1.00	1.00	1.00	0.000	1.00	1.00	1.00	0.000	1.00	1.00	1.00	0.000
5	1.32	1.27	1.38	.020	1.31	1.24	1.37	.021	1.32	1.28	1.36	.016
10	1.57	1.45	1.69	.038	1.55	1.43	1.67	.035	1.57	1.48	1.66	.029
20	1.82	1.61	2.02	.055	1.79	1.60	1.98	.047	1.80	1.65	1.96	.042
50	2.14	1.78	2.49	.080	2.09	1.80	2.38	.061	2.13	1.87	2.40	.060
100	2.38	1.89	2.87	.099	2.29	1.92	2.66	.076	2.37	2.01	2.73	.075
200	2.63	1.98	3.29	.120	2.49	2.03	2.95	.082	2.60	2.12	3.08	.091
500	2.98	2.07	3.89	.148	2.75	2.15	3.35	.096	2.92	2.25	3.59	.113

STATISTICS OF STATION DATA YEARS USED FOR SINGLE STATION ANALYSES

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
66.00	10.00	17.00	22.06	12.97	.59	37.00	10.00	28.00	24.77	8.70	.35	66.00	10.00	21.00	22.61	11.92	.52

EXPECTED PROBABILITY COMPUTATIONS FOR REGIONAL RATIOS (ALL DATA)

RETURN PERIOD	EXCEEDANCE PROBABILITY	EXPECTED PROBABILITY	
3.3	.300	.308	[3.3]
10.0	.100	.112	[9.0]
20.0	.050	.062	[16.2]
100.0	.010	.017	[59.1]
200.0	.005	.012	[84.0]
1000.0	.001	.003	[312.7]

[312.7] - DENOTES ASSOCIATED RETURN PERIOD

TABLE : 5.1.13

STATION PARAMETER STATISTICS FOR REGION 5

---NOTE--- THE FOLLOWING STATISTICS DO NOT INCLUDE DATA WHICH ARE LESS THAN 10 YEARS

TOTAL NUMBER OF STATIONS USED IN CALCULATIONS : 17 NATURAL: 14 REGULATED: 3

RETURN PERIOD	DISCHARGE RATIO (NATURAL) MAX	MIN	MED	MEAN	STD	CV	DISCHARGE RATIO (REGULATED) MAX	MIN	MED	MEAN	STD	CV	DISCHARGE RATIO (ALL DATA) MAX	MIN	MED	MEAN	STD	CV
1.25	.37	.88	.93	.93	.02	.02	.98	.94	.95	.96	.02	.02	.98	.88	.94	.94	.02	.02
2	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00
5	1.93	1.13	1.30	1.32	.12	.09	1.21	1.18	1.20	1.20	.02	.01	1.63	1.13	1.47	1.38	.12	.09
10	2.23	1.22	1.54	1.60	.25	.16	1.45	1.29	1.36	1.37	.08	.06	2.23	1.22	1.50	1.56	.24	.16
20	2.88	1.29	1.77	1.88	.39	.22	1.81	1.36	1.48	1.55	.23	.15	2.88	1.29	1.74	1.82	.38	.22
50	3.83	1.38	2.10	2.26	.61	.29	2.44	1.45	1.62	1.83	.53	.33	3.83	1.38	2.06	2.19	.60	.29
100	4.61	1.45	2.36	2.57	.80	.34	3.10	1.50	1.71	2.10	.87	.51	4.61	1.45	2.34	2.49	.80	.34
200	5.47	1.51	2.64	2.90	1.01	.38	3.92	1.54	1.80	2.42	1.31	.73	5.47	1.51	2.62	2.81	1.04	.40
500	6.74	1.59	3.04	3.35	1.33	.44	5.37	1.59	1.90	2.95	2.10	1.10	6.74	1.59	2.96	3.28	1.42	.48

STANDARD ERRORS OF ESTIMATE AND CONFIDENCE INTERVAL FOR REGIONAL RATIOS

RETURN PERIOD IN YEARS	NATURAL DATA ONLY: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL	RELATIVE STANDARD ERROR OF ESTIMATE	REGULATED DATA ONLY: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL	RELATIVE STANDARD ERROR OF ESTIMATE	ALL DATA INCLUDED: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL	RELATIVE STANDARD ERROR OF ESTIMATE
1.25	.93	.92 , .94	.006	.95	.94 , .98	.011	.94	.93 , .95	.006
2	1.00	1.00 , 1.00	0.000	1.00	1.00 , 1.00	0.000	1.00	1.00 , 1.00	0.000
5	1.30	1.23 , 1.37	.025	1.20	1.18 , 1.21	.009	1.27	1.21 , 1.33	.023
10	1.54	1.39 , 1.69	.043	1.36	1.29 , 1.45	.035	1.50	1.37 , 1.63	.039
20	1.77	1.54 , 2.01	.059	1.48	1.36 , 1.61	.089	1.74	1.54 , 1.95	.063
50	2.10	1.73 , 2.46	.078	1.62	1.45 , 2.44	.190	2.06	1.74 , 2.38	.071
100	2.36	1.88 , 2.84	.090	1.71	1.50 , 3.10	.293	2.34	1.92 , 2.77	.083
200	2.64	2.03 , 3.24	.102	1.80	1.54 , 3.92	.420	2.62	2.07 , 3.17	.096
500	3.04	2.24 , 3.84	.117	1.90	1.59 , 5.37	.635	2.96	2.21 , 3.71	.116

STATISTICS OF STATION DATA YEARS USED FOR SINGLE STATION ANALYSES

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
35.00	10.00	16.00	17.29	7.75	.45	28.00	10.00	28.00	22.00	10.39	.47	35.00	10.00	16.00	18.12	8.11	.45

EXPECTED PROBABILITY COMPUTATIONS FOR REGIONAL RATIOS (ALL DATA)

RETURN PERIOD	EXCEEDANCE PROBABILITY	EXPECTED PROBABILITY
3.3	.300	.309 [3.2]
10.0	.100	.115 [8.7]
20.0	.050	.065 [15.4]
100.0	.010	.019 [52.6]
200.0	.005	.014 [71.3]
1000.0	.001	.004 [241.5]

[241.5] - DENOTES ASSOCIATED RETURN PERIOD

TABLE : 5.1.14

STATION PARAMETER STATISTICS FOR REGION 6

---NOTE--- THE FOLLOWING STATISTICS DO NOT INCLUDE DATA WHICH ARE LESS THAN 10 YEARS

TOTAL NUMBER OF STATIONS USED IN CALCULATIONS = 14 NATURAL= 7 REGULATED= 7

RETURN PERIOD	DISCHARGE RATIO (NATURAL) MAX	MIN	MED	MEAN	STD	CV	DISCHARGE RATIO (REGULATED) MAX	MIN	MED	MEAN	STD	CV	DISCHARGE RATIO (ALL DATA) MAX	MIN	MED	MEAN	STD	CV
1.25	.35	.89	.91	.92	.02	.02	.95	.89	.91	.91	.02	.02	.95	.89	.91	.91	.02	.02
2	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00
5	1.59	1.20	1.39	1.40	.13	.09	1.55	1.28	1.46	1.41	.10	.07	1.58	1.20	1.43	1.41	.11	.08
10	2.18	1.35	1.73	1.77	.27	.16	2.08	1.48	1.83	1.77	.22	.12	2.18	1.35	1.78	1.77	.24	.13
20	2.86	1.50	2.07	2.16	.46	.22	2.65	1.65	2.19	2.14	.35	.16	2.86	1.50	2.13	2.15	.39	.18
50	3.91	1.69	2.55	2.72	.75	.30	3.48	1.86	2.66	2.64	.55	.21	3.91	1.69	2.60	2.68	.64	.24
100	4.82	1.81	2.91	3.18	1.02	.35	4.18	2.01	3.01	3.04	.73	.24	4.82	1.81	2.96	3.11	.86	.29
200	5.86	1.95	3.30	3.67	1.34	.41	4.93	2.14	3.36	3.46	.93	.28	5.86	1.95	3.33	3.56	1.11	.33
500	7.45	2.12	3.84	4.39	1.84	.48	6.05	2.32	3.84	4.06	1.24	.32	7.45	2.12	3.84	4.22	1.52	.39

STANDARD ERRORS OF ESTIMATE AND CONFIDENCE INTERVAL FOR REGIONAL RATIOS

RETURN PERIOD IN YEARS	NATURAL DATA ONLY: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL	RELATIVE STANDARD ERROR OF ESTIMATE	REGULATED DATA ONLY: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL	RELATIVE STANDARD ERROR OF ESTIMATE	ALL DATA INCLUDED: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL	RELATIVE STANDARD ERROR OF ESTIMATE
1.25	.91	.89 , .93	.008	.91	.89 , .93	.009	.91	.89 , .92	.006
2	1.00	1.00 , 1.00	0.000	1.00	1.00 , 1.00	0.000	1.00	1.00 , 1.00	0.000
5	1.39	1.26 , 1.52	.035	1.46	1.36 , 1.55	.027	1.43	1.36 , 1.49	.021
10	1.73	1.46 , 2.01	.060	1.83	1.61 , 2.05	.045	1.78	1.64 , 1.92	.036
20	2.07	1.62 , 2.53	.083	2.19	1.84 , 2.54	.060	2.13	1.90 , 2.37	.049
50	2.55	1.79 , 3.30	.112	2.66	2.11 , 3.21	.079	2.60	2.22 , 2.98	.065
100	2.91	1.88 , 3.93	.133	3.01	2.28 , 3.74	.092	2.96	2.44 , 3.47	.077
200	3.30	1.96 , 4.64	.153	3.36	2.43 , 4.29	.105	3.33	2.66 , 4.00	.089
500	3.84	2.12 , 5.67	.181	3.84	2.60 , 5.08	.122	3.84	2.93 , 4.75	.106

STATISTICS OF STATION DATA YEARS USED FOR SINGLE STATION ANALYSES

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
27.00	13.00	19.00	18.86	4.49	.24	27.00	12.00	19.00	19.86	5.21	.26	27.00	12.00	19.00	19.36	4.70	.24

EXPECTED PROBABILITY COMPUTATIONS FOR REGIONAL RATIOS (ALL DATA)

RETURN PERIOD	EXCEEDANCE PROBABILITY	EXPECTED PROBABILITY
3.3	.300	.309 [3.2]
10.0	.100	.114 [8.8]
20.0	.050	.064 [15.7]
100.0	.010	.018 [54.5]
200.0	.005	.013 [74.8]
1000.0	.001	.004 [260.8]

[260.8] - DENOTES ASSOCIATED RETURN PERIOD

STATION PARAMETER STATISTICS FOR REGION 7

---NOTE--- THE FOLLOWING STATISTICS DO NOT INCLUDE DATA WHICH ARE LESS THAN 10 YEARS

TOTAL NUMBER OF STATIONS USED IN CALCULATIONS : 8 NATURAL: 3 REGULATED: 5

RETURN PERIOD	DISCHARGE RATIO (NATURAL) MAX	MIN	MED	MEAN	STD	CV	DISCHARGE RATIO (REGULATED) MAX	MIN	MED	MEAN	STD	CV	DISCHARGE RATIO (ALL DATA) MAX	MIN	MED	MEAN	STD	CV
1.25	.94	.93	.93	.94	.01	.01	.95	.93	.94	.94	.01	.01	.95	.93	.94	.94	.01	.01
2	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00
5	1.28	1.25	1.27	1.27	.02	.01	1.32	1.19	1.26	1.26	.05	.04	1.32	1.19	1.27	1.27	.04	.03
10	1.50	1.42	1.48	1.46	.04	.03	1.58	1.32	1.46	1.47	.10	.07	1.58	1.32	1.47	1.47	.09	.06
20	1.69	1.57	1.66	1.64	.06	.04	1.82	1.46	1.66	1.68	.15	.09	1.82	1.46	1.66	1.66	.12	.07
50	1.92	1.75	1.88	1.85	.09	.05	2.15	1.63	1.91	1.94	.22	.11	2.15	1.63	1.90	1.91	.18	.09
100	2.10	1.88	2.05	2.01	.12	.06	2.41	1.75	2.10	2.14	.27	.13	2.41	1.75	2.07	2.09	.23	.11
200	2.26	1.99	2.20	2.15	.14	.06	2.68	1.86	2.28	2.33	.33	.14	2.68	1.86	2.24	2.27	.28	.12
500	2.48	2.13	2.42	2.34	.18	.08	3.05	2.02	2.54	2.60	.41	.16	3.05	2.02	2.47	2.50	.35	.14

STANDARD ERRORS OF ESTIMATE AND CONFIDENCE INTERVAL FOR REGIONAL RATIOS

RETURN PERIOD IN YEARS	NATURAL DATA ONLY: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL		RELATIVE STANDARD ERROR OF ESTIMATE	REGULATED DATA ONLY: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL		RELATIVE STANDARD ERROR OF ESTIMATE	ALL DATA INCLUDED: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL		RELATIVE STANDARD ERROR OF ESTIMATE
1.25	.93	.93	.94	.004	.94	.93	.95	.004	.94	.93	.94	.003
2	1.00	1.00	1.00	0.000	1.00	1.00	1.00	0.000	1.00	1.00	1.00	0.000
5	1.27	1.25	1.28	.007	1.26	1.19	1.32	.019	1.27	1.23	1.30	.011
10	1.48	1.42	1.50	.015	1.46	1.32	1.58	.031	1.47	1.40	1.54	.019
20	1.66	1.57	1.69	.022	1.66	1.46	1.82	.040	1.66	1.55	1.77	.025
50	1.88	1.75	1.92	.028	1.91	1.63	2.15	.051	1.90	1.74	2.05	.033
100	2.05	1.88	2.10	.033	2.10	1.75	2.41	.058	2.07	1.87	2.27	.039
200	2.20	1.99	2.26	.037	2.28	1.86	2.68	.065	2.24	2.00	2.49	.044
500	2.42	2.13	2.48	.044	2.54	2.02	3.05	.073	2.47	2.15	2.78	.051

STATISTICS OF STATION DATA YEARS USED FOR SINGLE STATION ANALYSES

NATURAL DATA ONLY: MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY: MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED: MAX	MIN	MED	MEAN	STD	CV
26.00	10.00	11.00	15.67	8.96	.57	26.00	10.00	24.00	20.80	6.61	.32	26.00	10.00	21.50	18.86	7.41	.39

EXPECTED PROBABILITY COMPUTATIONS FOR REGIONAL RATIOS (ALL DATA)

RETURN PERIOD	EXCEEDANCE PROBABILITY	EXPECTED PROBABILITY
3.3	.300	.309 [3.2]
10.0	.100	.114 [8.8]
20.0	.050	.064 [15.6]
100.0	.010	.019 [53.7]
200.0	.005	.014 [73.5]
1000.0	.001	.004 [253.3]

[253.3] - DENOTES ASSOCIATED RETURN PERIOD

TABLE : 5.1.16

STATION PARAMETER STATISTICS FOR REGION 8

---NOTE--- THE FOLLOWING STATISTICS DO NOT INCLUDE DATA WHICH ARE LESS THAN 10 YEARS

TOTAL NUMBER OF STATIONS USED IN CALCULATIONS : 37 NATURAL: 34 REGULATED: 3

RETURN PERIOD	DISCHARGE RATIO (NATURAL) MAX	MIN	MED	MEAN	STD	CV	DISCHARGE RATIO (REGULATED) MAX	MIN	MED	MEAN	STD	CV	DISCHARGE RATIO (ALL DATA) MAX	MIN	MED	MEAN	STD	CV
1.25	.35	.86	.91	.91	.02	.03	.97	.91	.92	.93	.03	.04	.97	.86	.92	.91	.03	.03
2	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00
5	1.75	1.19	1.44	1.43	.15	.10	1.56	1.10	1.36	1.34	.23	.17	1.75	1.10	1.43	1.42	.15	.11
10	2.51	1.32	1.87	1.84	.32	.17	2.16	1.14	1.68	1.66	.51	.30	2.51	1.14	1.85	1.82	.33	.18
20	3.36	1.43	2.32	2.27	.53	.23	2.85	1.18	1.99	2.01	.83	.42	3.36	1.18	2.30	2.25	.55	.24
50	4.68	1.55	2.97	2.92	.89	.30	3.92	1.21	2.41	2.51	1.36	.56	4.68	1.21	2.96	2.88	.92	.31
100	5.82	1.64	3.50	3.46	1.22	.35	4.87	1.23	2.74	2.95	1.83	.67	5.82	1.23	3.46	3.42	1.25	.36
200	7.11	1.72	4.09	4.05	1.61	.39	5.95	1.24	3.08	3.43	2.37	.77	7.11	1.24	4.00	4.01	1.65	.41
500	9.06	1.82	4.93	4.96	2.24	.45	7.62	1.26	3.55	4.14	3.22	.91	9.06	1.26	4.77	4.89	2.29	.48

STANDARD ERRORS OF ESTIMATE AND CONFIDENCE INTERVAL FOR REGIONAL RATIOS

RETURN PERIOD IN YEARS	NATURAL DATA ONLY: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL	RELATIVE STANDARD ERROR OF ESTIMATE	REGULATED DATA ONLY: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL	RELATIVE STANDARD ERROR OF ESTIMATE	ALL DATA INCLUDED: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL	RELATIVE STANDARD ERROR OF ESTIMATE
1.25	.91	.90 ; .92	.005	.92	.91 ; .97	.022	.92	.91 ; .93	.005
2	1.00	1.00 ; 1.00	0.000	1.00	1.00 ; 1.00	0.000	1.00	1.00 ; 1.00	0.000
5	1.44	1.38 ; 1.49	.018	1.36	1.18 ; 1.56	.100	1.43	1.38 ; 1.49	.018
10	1.87	1.76 ; 1.98	.029	1.68	1.14 ; 2.16	.175	1.85	1.74 ; 1.96	.029
20	2.32	2.13 ; 2.51	.039	1.99	1.18 ; 2.85	.242	2.30	2.12 ; 2.49	.039
50	2.97	2.65 ; 3.29	.051	2.41	1.21 ; 3.92	.325	2.96	2.65 ; 3.27	.051
100	3.50	3.07 ; 3.93	.060	2.74	1.23 ; 4.87	.385	3.46	3.03 ; 3.88	.059
200	4.09	3.52 ; 4.66	.068	3.08	1.24 ; 5.95	.445	4.00	3.44 ; 4.56	.068
500	4.93	4.14 ; 5.73	.078	3.55	1.26 ; 7.62	.525	4.77	3.99 ; 5.54	.079

STATISTICS OF STATION DATA YEARS USED FOR SINGLE STATION ANALYSES

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
37.00	10.00	17.00	18.65	6.78	.36	58.00	11.00	23.00	30.67	24.42	.80	58.00	10.00	17.00	19.62	9.29	.47

EXPECTED PROBABILITY COMPUTATIONS FOR REGIONAL RATIOS (ALL DATA)

RETURN PERIOD	EXCEEDANCE PROBABILITY	EXPECTED PROBABILITY
3.3	.300	.309 [3.2]
10.0	.100	.114 [8.8]
20.0	.050	.064 [15.7]
100.0	.010	.018 [54.9]
200.0	.005	.013 [75.6]
1000.0	.001	.004 [264.8]

[264.8] - DENOTES ASSOCIATED RETURN PERIOD

TABLE : 5.1.17

STATION PARAMETER STATISTICS FOR REGION 9

---NOTE--- THE FOLLOWING STATISTICS DO NOT INCLUDE DATA WHICH ARE LESS THAN 10 YEARS

TOTAL NUMBER OF STATIONS USED IN CALCULATIONS : 12 NATURAL: 11 REGULATED: 1

RETURN PERIOD	DISCHARGE RATIO (NATURAL) MAX	MIN	MED	MEAN	STD	CV	DISCHARGE RATIO (REGULATED) MAX	MIN	MED	MEAN	STD	CV	DISCHARGE RATIO (ALL DATA) MAX	MIN	MED	MEAN	STD	CV
1.25	.96	.91	.95	.94	.02	.02	.94	.94	.94	.94	0.00	0.00	.96	.91	.94	.94	.02	.02
2	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00
5	1.43	1.14	1.23	1.26	.10	.08	1.34	1.34	1.34	1.34	0.00	0.00	1.43	1.14	1.27	1.26	.10	.08
10	1.82	1.23	1.41	1.47	.20	.15	1.72	1.72	1.72	1.72	0.00	0.00	1.82	1.23	1.50	1.49	.21	.14
20	2.22	1.32	1.56	1.68	.32	.20	2.16	2.16	2.16	2.16	0.00	0.00	2.22	1.32	1.72	1.72	.33	.19
50	2.77	1.42	1.77	1.97	.50	.28	2.87	2.87	2.87	2.87	0.00	0.00	2.87	1.42	2.02	2.05	.54	.27
100	3.22	1.49	1.92	2.19	.65	.34	3.51	3.51	3.51	3.51	0.00	0.00	3.51	1.49	2.26	2.30	.72	.32
200	3.69	1.55	2.08	2.43	.81	.39	4.25	4.25	4.25	4.25	0.00	0.00	4.25	1.55	2.49	2.58	.93	.37
500	4.41	1.63	2.28	2.75	1.06	.47	5.42	5.42	5.42	5.42	0.00	0.00	5.42	1.63	2.80	2.98	1.27	.45

STANDARD ERRORS OF ESTIMATE AND CONFIDENCE INTERVAL FOR REGIONAL RATIOS

RETURN PERIOD IN YEARS	NATURAL DATA ONLY: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL		RELATIVE STANDARD ERROR OF ESTIMATE	REGULATED DATA ONLY: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL		RELATIVE STANDARD ERROR OF ESTIMATE	ALL DATA INCLUDED: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL		RELATIVE STANDARD ERROR OF ESTIMATE
1.25	.95	.94	.96	.006	.94	.94	.94	0.000	.94	.93	.96	.006
2	1.00	1.00	1.00	0.000	1.00	1.00	1.00	0.000	1.00	1.00	1.00	0.000
5	1.23	1.16	1.30	.025	1.34	1.34	1.34	0.000	1.27	1.20	1.33	.022
10	1.41	1.26	1.55	.044	1.72	1.72	1.72	0.000	1.50	1.36	1.64	.040
20	1.56	1.34	1.79	.062	2.16	2.16	2.16	0.000	1.72	1.50	1.94	.056
50	1.77	1.42	2.13	.084	2.87	2.87	2.87	0.000	2.02	1.67	2.38	.077
100	1.92	1.49	2.38	.102	3.51	3.51	3.51	0.000	2.26	1.78	2.74	.092
200	2.08	1.55	2.66	.118	4.25	4.25	4.25	0.000	2.49	1.87	3.11	.108
500	2.28	1.63	3.04	.140	5.42	5.42	5.42	0.000	2.80	1.96	3.65	.131

STATISTICS OF STATION DATA YEARS USED FOR SINGLE STATION ANALYSES

NATURAL DATA ONLY: MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY: MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED: MAX	MIN	MED	MEAN	STD	CV
67.00	10.00	16.00	19.18	16.15	.84	13.00	13.00	13.00	13.00	0.00	0.00	67.00	10.00	14.50	18.67	15.51	.83

EXPECTED PROBABILITY COMPUTATIONS FOR REGIONAL RATIOS (ALL DATA)

RETURN PERIOD	EXCEEDANCE PROBABILITY	EXPECTED PROBABILITY
3.3	.300	.309 [3.2]
10.0	.100	.114 [8.7]
20.0	.050	.064 [15.6]
100.0	.010	.019 [53.4]
200.0	.005	.014 [72.9]
1000.0	.001	.004 [250.1]

[250.1] - DENOTES ASSOCIATED RETURN PERIOD

TABLE : 5.1.18

STATION PARAMETER STATISTICS FOR REGION 10

---NOTE--- THE FOLLOWING STATISTICS DO NOT INCLUDE DATA WHICH ARE LESS THAN 10 YEARS

TOTAL NUMBER OF STATIONS USED IN CALCULATIONS : 13 NATURAL: 11 REGULATED: 2

RETURN PERIOD	DISCHARGE RATIO (NATURAL) MAX	MIN	MED	MEAN	STD	CV	DISCHARGE RATIO (REGULATED) MAX	MIN	MED	MEAN	STD	CV	DISCHARGE RATIO (ALL DATA) MAX	MIN	MED	MEAN	STD	CV
1.25	.97	.92	.95	.95	.01	.02	.95	.95	.95	.95	.00	.00	.97	.92	.95	.95	.01	.01
2	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00
5	1.38	1.14	1.20	1.23	.09	.08	1.23	1.19	1.21	1.21	.02	.02	1.38	1.14	1.20	1.23	.08	.07
10	1.82	1.23	1.35	1.43	.20	.15	1.40	1.34	1.37	1.37	.04	.03	1.82	1.23	1.35	1.42	.19	.14
20	2.37	1.29	1.48	1.62	.34	.23	1.55	1.47	1.51	1.51	.06	.04	2.37	1.29	1.48	1.61	.32	.21
50	3.29	1.35	1.64	1.89	.58	.35	1.75	1.62	1.69	1.69	.09	.05	3.29	1.35	1.64	1.86	.54	.33
100	4.13	1.39	1.77	2.11	.81	.46	1.89	1.72	1.80	1.80	.12	.07	4.13	1.39	1.77	2.06	.75	.42
200	5.15	1.43	1.90	2.34	1.00	.57	2.03	1.83	1.93	1.93	.14	.08	5.15	1.43	1.90	2.28	1.00	.53
500	6.79	1.47	2.07	2.68	1.33	.74	2.22	1.95	2.08	2.08	.19	.09	6.79	1.47	2.07	2.59	1.42	.68

STANDARD ERRORS OF ESTIMATE AND CONFIDENCE INTERVAL FOR REGIONAL RATIOS

RETURN PERIOD IN YEARS	NATURAL DATA ONLY: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL	RELATIVE STANDARD ERROR OF ESTIMATE	REGULATED DATA ONLY: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL	RELATIVE STANDARD ERROR OF ESTIMATE	ALL DATA INCLUDED: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL	RELATIVE STANDARD ERROR OF ESTIMATE
1.25	.95	.94 , .96	.005	.95	.95 , .95	.001	.95	.94 , .96	.004
2	1.00	1.00 , 1.00	0.000	1.00	1.00 , 1.00	0.000	1.00	1.00 , 1.00	0.000
5	1.20	1.14 , 1.26	.023	1.21	1.19 , 1.23	.014	1.20	1.14 , 1.25	.020
10	1.35	1.23 , 1.49	.045	1.37	1.34 , 1.40	.021	1.35	1.23 , 1.47	.038
20	1.48	1.29 , 1.72	.070	1.51	1.47 , 1.55	.029	1.48	1.29 , 1.67	.059
50	1.64	1.35 , 2.06	.106	1.69	1.62 , 1.75	.039	1.[illegible]	1.35 , 1.98	.090
100	1.77	1.39 , 2.35	.137	1.80	1.72 , 1.89	.048	1.77	1.39 , 2.24	.117
200	1.90	1.43 , 2.67	.172	1.93	1.83 , 2.03	.053	1.90	1.43 , 2.53	.146
500	2.07	1.47 , 3.16	.223	2.08	1.95 , 2.22	.064	2.07	1.47 , 2.96	.190

STATISTICS OF STATION DATA YEARS USED FOR SINGLE STATION ANALYSES

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
63.00	10.00	15.00	22.55	16.20	.72	64.00	62.00	63.00	63.00	1.41	.02	64.00	10.00	16.00	26.77	21.21	.74

EXPECTED PROBABILITY COMPUTATIONS FOR REGIONAL RATIOS (ALL DATA)

RETURN PERIOD	EXCEEDANCE PROBABILITY	EXPECTED PROBABILITY	
3.3	.300	.306	[3.3]
10.0	.100	.109	[9.2]
20.0	.050	.059	[16.9]
100.0	.010	.015	[65.4]
200.0	.005	.010	[97.3]
1000.0	.001	.003	[394.6]

[394.6] - DENOTES ASSOCIATED RETURN PERIOD

TABLE : 5.1.19

STATION PARAMETER STATISTICS FOR REGION 11

---NOTE--- THE FOLLOWING STATISTICS DO NOT INCLUDE DATA WHICH ARE LESS THAN 10 YEARS

TOTAL NUMBER OF STATIONS USED IN CALCULATIONS = 31 NATURAL= 30 REGULATED= 1

RETURN PERIOD	DISCHARGE RATIO (NATURAL) MAX	MIN	MED	MEAN	STD	CV	DISCHARGE RATIO (REGULATED) MAX	MIN	MED	MEAN	STD	CV	DISCHARGE RATIO (ALL DATA) MAX	MIN	MED	MEAN	STD	CV
1.25	.95	.89	.93	.93	.02	.02	.93	.93	.93	.93	0.00	0.00	.95	.89	.93	.93	.02	.02
2	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00
5	1.57	1.19	1.33	1.34	.10	.08	1.27	1.27	1.27	1.27	0.00	0.00	1.57	1.19	1.33	1.34	.10	.07
10	2.16	1.32	1.63	1.65	.22	.13	1.49	1.49	1.49	1.49	0.00	0.00	2.16	1.32	1.62	1.65	.22	.13
20	2.82	1.44	1.93	1.97	.36	.19	1.68	1.68	1.68	1.68	0.00	0.00	2.82	1.44	1.90	1.96	.37	.19
50	3.84	1.58	2.37	2.42	.60	.25	1.93	1.93	1.93	1.93	0.00	0.00	3.84	1.58	2.32	2.41	.59	.26
100	4.73	1.69	2.71	2.79	.81	.30	2.12	2.12	2.12	2.12	0.00	0.00	4.73	1.69	2.67	2.77	.81	.30
200	5.76	1.79	3.07	3.19	1.06	.35	2.30	2.30	2.30	2.30	0.00	0.00	5.76	1.79	3.05	3.17	1.05	.35
500	7.30	1.91	3.57	3.77	1.45	.41	2.53	2.53	2.53	2.53	0.00	0.00	7.30	1.91	3.55	3.73	1.44	.41

STANDARD ERRORS OF ESTIMATE AND CONFIDENCE INTERVAL FOR REGIONAL RATIOS

RETURN PERIOD IN YEARS	NATURAL DATA ONLY: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL	RELATIVE STANDARD ERROR OF ESTIMATE	REGULATED DATA ONLY: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL	RELATIVE STANDARD ERROR OF ESTIMATE	ALL DATA INCLUDED: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL	RELATIVE STANDARD ERROR OF ESTIMATE
1.25	.93	.92 , .93	.003	.93	.93 , .93	0.000	.93	.92 , .93	.003
2	1.00	1.00 , 1.00	0.000	1.00	1.00 , 1.00	0.000	1.00	1.00 , 1.00	0.000
5	1.33	1.30 , 1.37	.014	1.27	1.27 , 1.27	0.000	1.33	1.29 , 1.37	.013
10	1.63	1.55 , 1.71	.024	1.49	1.49 , 1.49	0.000	1.62	1.54 , 1.70	.024
20	1.93	1.79 , 2.06	.034	1.68	1.68 , 1.68	0.000	1.90	1.76 , 2.03	.034
50	2.37	2.14 , 2.59	.046	1.93	1.93 , 1.93	0.000	2.32	2.10 , 2.54	.046
100	2.71	2.40 , 3.01	.055	2.12	2.12 , 2.12	0.000	2.67	2.37 , 2.97	.054
200	3.07	2.67 , 3.47	.063	2.30	2.30 , 2.30	0.000	3.05	2.66 , 3.45	.062
500	3.57	3.02 , 4.12	.074	2.53	2.53 , 2.53	0.000	3.55	3.01 , 4.09	.073

STATISTICS OF STATION DATA YEARS USED FOR SINGLE STATION ANALYSES

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
62.00	10.00	14.50	23.40	17.80	.76	53.00	53.00	53.00	53.00	0.00	0.00	62.00	10.00	15.00	24.35	18.29	.75

EXPECTED PROBABILITY COMPUTATIONS FOR REGIONAL RATIOS (ALL DATA)

RETURN PERIOD	EXCEEDANCE PROBABILITY	EXPECTED PROBABILITY
3.3	.300	.307 [3.3]
10.0	.100	.111 [9.0]
20.0	.050	.061 [16.4]
100.0	.010	.016 [61.0]
200.0	.005	.011 [87.7]
1000.0	.001	.003 [334.9]

[334.9] - DENOTES ASSOCIATED RETURN PERIOD

TABLE # 5.1.20

STATION PARAMETER STATISTICS FOR REGION 12

---NOTE--- THE FOLLOWING STATISTICS DO NOT INCLUDE DATA WHICH ARE LESS THAN 10 YEARS

TOTAL NUMBER OF STATIONS USED IN CALCULATIONS = 9 NATURAL= 8 REGULATED= 1

RETURN PERIOD	DISCHARGE RATIO (NATURAL) MAX	MIN	MED	MEAN	STD	CV	DISCHARGE RATIO (REGULATED) MAX	MIN	MED	MEAN	STD	CV	DISCHARGE RATIO (ALL DATA) MAX	MIN	MED	MEAN	STD	CV
1.25	.96	.91	.94	.94	.02	.02	.96	.96	.96	.96	0.00	0.00	.96	.91	.94	.94	.02	.02
2	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00
5	1.42	1.11	1.26	1.27	.13	.10	1.15	1.15	1.15	1.15	0.00	0.00	1.42	1.11	1.22	1.26	.13	.10
10	1.87	1.17	1.46	1.52	.29	.20	1.28	1.28	1.28	1.28	0.00	0.00	1.87	1.17	1.38	1.49	.29	.20
20	2.52	1.21	1.64	1.79	.52	.32	1.40	1.40	1.40	1.40	0.00	0.00	2.52	1.21	1.52	1.74	.50	.33
50	3.70	1.27	1.88	2.20	.93	.49	1.57	1.57	1.57	1.57	0.00	0.00	3.70	1.27	1.68	2.13	.89	.53
100	4.87	1.29	2.05	2.56	1.32	.64	1.69	1.69	1.69	1.69	0.00	0.00	4.87	1.29	1.80	2.46	1.27	.71
200	6.33	1.31	2.22	2.97	1.82	.92	1.81	1.81	1.81	1.81	0.00	0.00	6.33	1.31	1.90	2.84	1.75	.92
500	8.82	1.33	2.45	3.63	2.67	1.09	1.98	1.98	1.98	1.98	0.00	0.00	8.82	1.33	2.05	3.44	2.56	1.25

STANDARD ERRORS OF ESTIMATE AND CONFIDENCE INTERVAL FOR REGIONAL RATIOS

RETURN PERIOD IN YEARS	NATURAL DATA ONLY: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL	RELATIVE STANDARD ERROR OF ESTIMATE	REGULATED DATA ONLY: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL	RELATIVE STANDARD ERROR OF ESTIMATE	ALL DATA INCLUDED: REGIONAL CURVE ORDINATE (MEDIAN)	95 PERCENT CONFIDENCE INTERVAL	RELATIVE STANDARD ERROR OF ESTIMATE
1.25	.94	.93 ; .96	.007	.96	.96 ; .96	0.000	.94	.93 ; .96	.006
2	1.00	1.00 ; 1.00	0.000	1.00	1.00 ; 1.00	0.000	1.00	1.00 ; 1.00	0.000
5	1.26	1.15 ; 1.37	.036	1.15	1.15 ; 1.15	0.000	1.22	1.12 ; 1.32	.034
10	1.46	1.19 ; 1.72	.071	1.28	1.28 ; 1.28	0.000	1.38	1.17 ; 1.61	.069
20	1.64	1.21 ; 2.11	.112	1.40	1.40 ; 1.40	0.000	1.52	1.21 ; 1.93	.110
50	1.88	1.27 ; 2.71	.174	1.57	1.57 ; 1.57	[illegible]	1.68	1.27 ; 2.41	.177
100	2.05	1.29 ; 3.24	.228	1.69	1.69 ; 1.69	0.000	1.80	1.29 ; 2.84	.236
200	2.22	1.31 ; 3.85	.290	1.81	1.81 ; 1.81	0.000	1.90	1.31 ; 3.33	.386
500	2.45	1.33 ; 4.84	.385	1.98	1.98 ; 1.98	0.000	2.05	1.33 ; 4.14	.416

STATISTICS OF STATION DATA YEARS USED FOR SINGLE STATION ANALYSES

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
16.00	10.00	14.50	13.38	2.62	.20	20.00	20.00	20.00	20.00	0.00	0.00	20.00	10.00	15.00	14.11	3.30	.23

EXPECTED PROBABILITY COMPUTATIONS FOR REGIONAL RATIOS (ALL DATA)

RETURN PERIOD	EXCEEDANCE PROBABILITY	EXPECTED PROBABILITY
3.3	.300	.312 [3.2]
10.0	.100	.119 [8.4]
20.0	.050	.069 [14.5]
100.0	.010	.022 [45.3]
200.0	.005	.017 [58.6]
1000.0	.001	.006 [177.7]

[177.7] - DENOTES ASSOCIATED RETURN PERIOD

TABLE # 5.1.21

The regional equations were analysed to determine the similarity of flow predictions using drainage areas of 100, 1,000 and 5,000 km^2. The results are shown on Table 5.1.22

Table 5.1.22

Comparison of Regional Equations for the Index Method

Region Number	1	2	3	4	5	6	7	8	9	10	11	12
Area= 100(km^2)												
Q2	19	32	16	34	16	17	28	27	17	14	10	NA
Q100	39	72	41	81	37	50	58	93	38	25	27	NA
Area=1,000(km^2)												
Q2	96	248	148	238	95	107	122	163	107	98	50	NA
Q100	197	558	376	564	222	317	254	564	242	173	133	NA
Area=5,000 (km^2)												
Q2	301	NA	NA	924	331	NA	NA	NA	NA	387	155	399
Q100	614	NA	NA	2190	775	NA	NA	NA	NA	685	414	718

Notes: Q2 = 2-year flow (index flood) in m^3/s

Q100 = 100-year flow (index flood) in m^3/s

NA indicates that the regional equation is not applicable as the drainage area is outside of the range used to develop the relationship.

From Table 5.1.22, the regional relationships for the following groups of region for each drainage area tested give flows within 15% of the mean value.

a) Drainage Area = 100 km^2
Regions: (1,3,5,9); (2,4,8); (6,7)

b) Drainage Area = 1000 km^2
Regions: (1,5,7,9); (2,4,8); (3,6)

c) Drainage Area = 5000 km^2
Regions: (1,5,10,12)

The above indicates that caution should be used in estimating flows for watersheds close to the regional boundaries where large differences in flow estimates could result when both equations are used.

5.2 Error Analysis

In order to determine the accuracy and reliability of the regional relationships an error analysis was carried out. The standard error of estimate for the ordinate values (median) of the dimensionless frequency plots were computed from the expression:

$$SE = SD/(NS)^{1/2}$$

and the relative standard error of estimate is computed as:

$$RSE = SE/Rmt \qquad (1)$$

where:

SE = standard error of estimate of ordinate
SD = standard deviation of the median
NS = number of stations in the region
Rmt = mean of the median ordinate value for the region

The corresponding 95% confidence interval is determined from the expression:

$$Rcl = Rmt \quad SE \times t$$

where:

Rcl= extreme values of range for 95% confidence interval
t = student's t for (NS-2) degrees of freedom
(eg. t=2.45 for NS=8, t=2.00 for NS=60)

The confidence intervals and relative standard errors of estimate for the data used to plot the frequency curves, shown in Figures 5.2.2 to 5.13.2, can be found in Tables 5.1.10 to 5.1.21.

The regional relationship between the index flood and drainage area was established using the computer program SPSS to compute the regression equation. Several curves were modified to give more weight to the stations having 10 or more years of data. A regression fit was then derived to the plotted curve using a weighting method.

The standard error of estimate for these regressions are shown in Table 5.1.3 below the "Q2" header.

The standard error for the log transformed dependent variable (Index Flood curves) is dimensionless and in logarithmic units. This SE may be transformed back as a ratio in normal units (antilog of log regression line) by using the following procedure:

$\log Y + \log Te = \log (Y \times Te)$ = Upper error limit

$\log Y - \log Te = \log (Y / Te)$ = Lower error limit

where:

Y = predicted value on regression line

Te = antilog of SE

Converting upper (U) and lower (L) error limits to actual flows and computing the relative standard error of estimate gives the following:

$$U = (Y \times Te - Y) / Y$$

$$L = (Y - Y/Te) / Y$$

which reduces to:

$$U = (Te - 1) \qquad (2)$$

$$L = (1 - 1 / Te) \qquad (3)$$

the average of the two limits gives:

$$RSE(av) = (Te^2 + 1)^{1/2} \qquad (4)$$

solving for Te :

$$Te = RSE + (RSE^2 + 1)^{1/2}$$

Equation (4) was used to estimate the standard error of the log transformed dimensionless frequency curves which are presented in the study as untransformed plots. (SE - log Te). The relative standard error of estimate of the individual station curves about the median ratio (RSEt) was used for this computation where:

$$RSEt = RSE \times (NS)^{1/2}$$

or, $RSEt = SD / Rmt$

hence, $SEt = (NS)^{1/2} \times \log Te$

A composite standard error of estimate for the combined regional relationships was computed using the expression:

$$SEc = (SE1^2 + SE2^2)^{1/2}$$

where:

SEc = composite standard error of estimate for the regional relationships

SE1 = standard error for index flood versus drainage area regression

SE2 = log transformed relative standard error for dimensionless single station frequency curves (about median) = SEt

These values were computed for various return period floods in each region and are shown in Table 5.1.3, along with the mean values for station data used (number of stations, period of record) to derive both relationships.

Table 5.2.1

Standard Error of Estimate for Regional Relationships

Index Method

Region	Regional Data		Composite Standard Error of Estimate (SE) for various return period floods					
Number	NS	NY	Q2	Q5	Q10	Q20	Q50	Q100
1(a)	21	16.6	.25	.25	.26	.26	.28	.29
1(b)	35	18.6	.13	.13	.14	.15	.18	.20
2	9	24.4	.15	.15	.16	.17	.19	.21
3	16	25.3	.16	.16	.17	.17	.18	.18
4	49	22.3	.21	.22	.23	.24	.28	.31
5	18	17.5	.15	.16	.17	.18	.20	.21
6	17	16.2	.32	.32	.33	.33	.34	.34
7	10	18.4	.23	.23	.23	.23	.23	.23
8	43	18.1	.22	.23	.23	.24	.26	.27
9	13	17.0	.16	.16	.17	.18	.20	.21
10	15	22.8	.16	.16	.17	.19	.21	.24
11	34	21.8	.26	.26	.27	.27	.28	.29
12	9	13.7	.20	.20	.22	.25	.30	.36

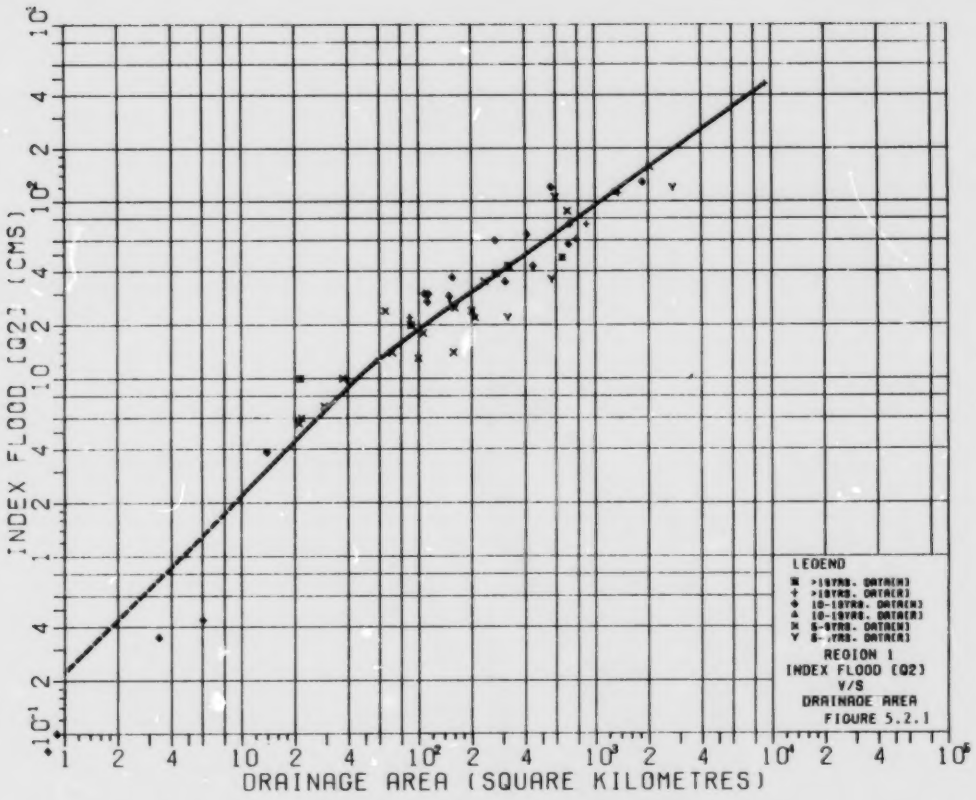
Notes: NS = mean number of stations used for regional relationships

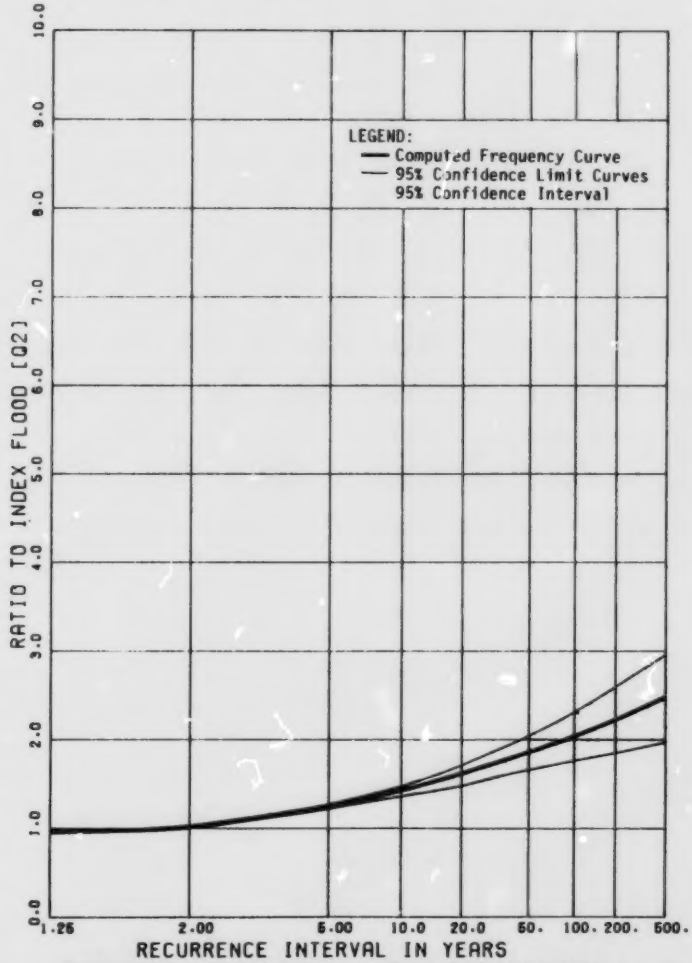
NY = mean number of data years used for regional relationships

SE_c in log units

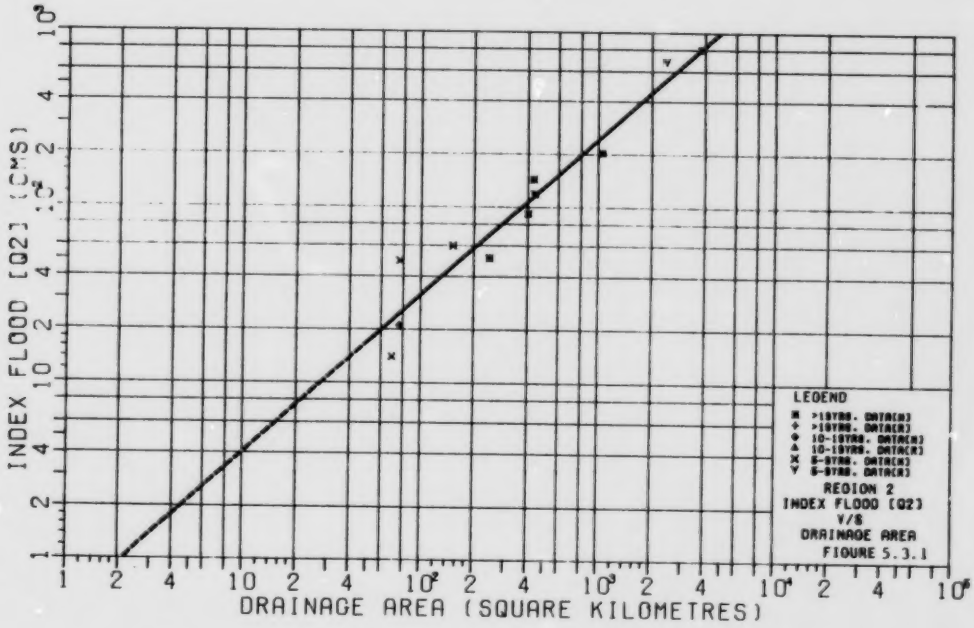
(a) denotes lower range of regional curve A < 60 km^2

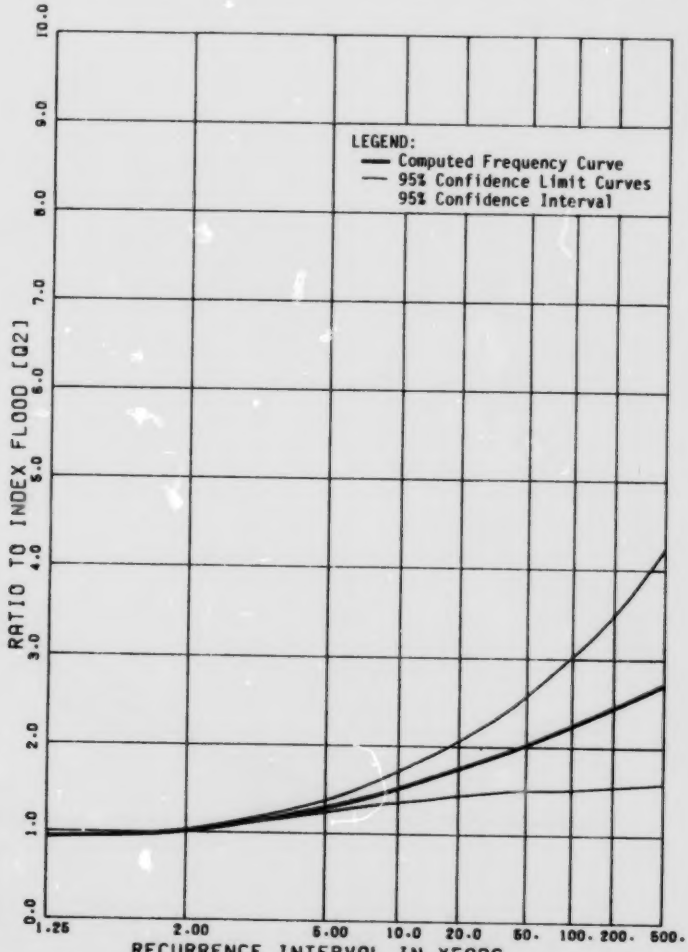
(b) denotes upper range of regional curve A > 60 km^2





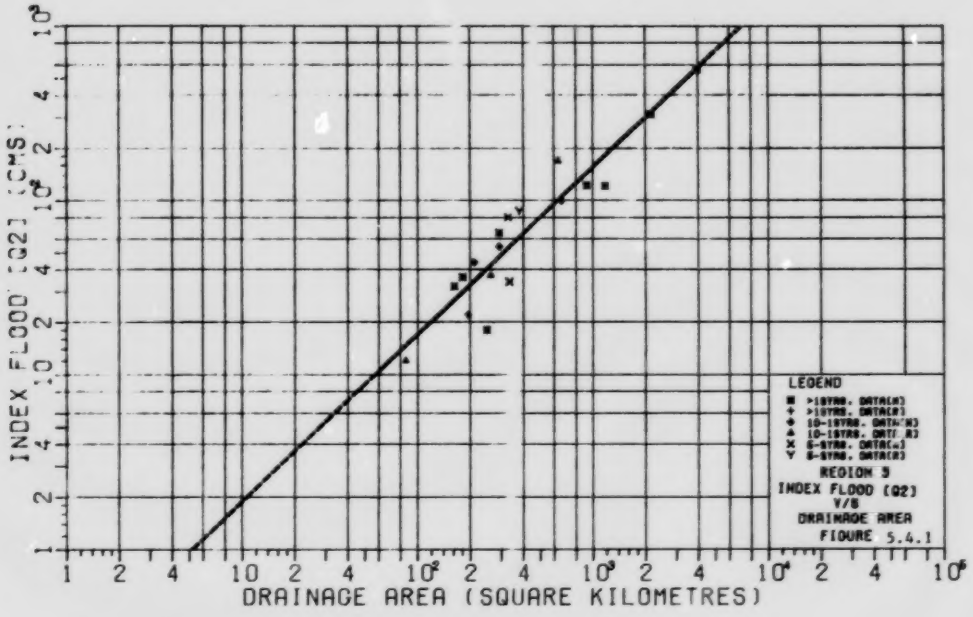
REGIONAL FREQUENCY CURVE FOR REGION 1 (Figure 5.2.2)





. REGIONAL FREQUENCY CURVE FOR REGION 2

FIGURE 5.3.2


INDEX FLOOD (Q2) (CMS)
DRAINAGE AREA (SQUARE KILOMETRES)
LEGEND
REGION 3
INDEX FLOOD (Q2)
Y/B
DRAINAGE AREA
FIGURE 5.4.1

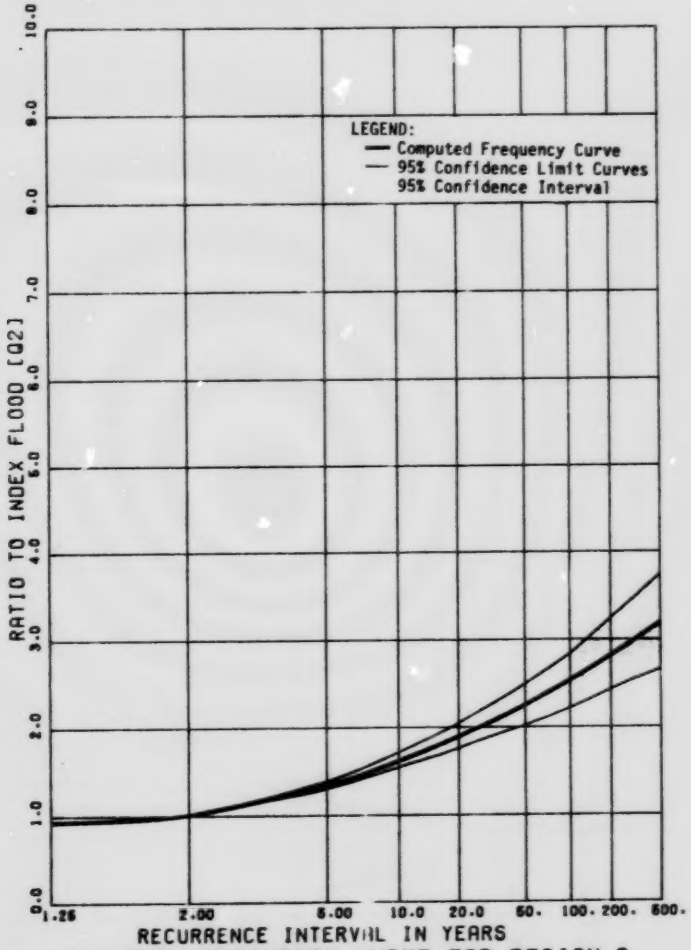
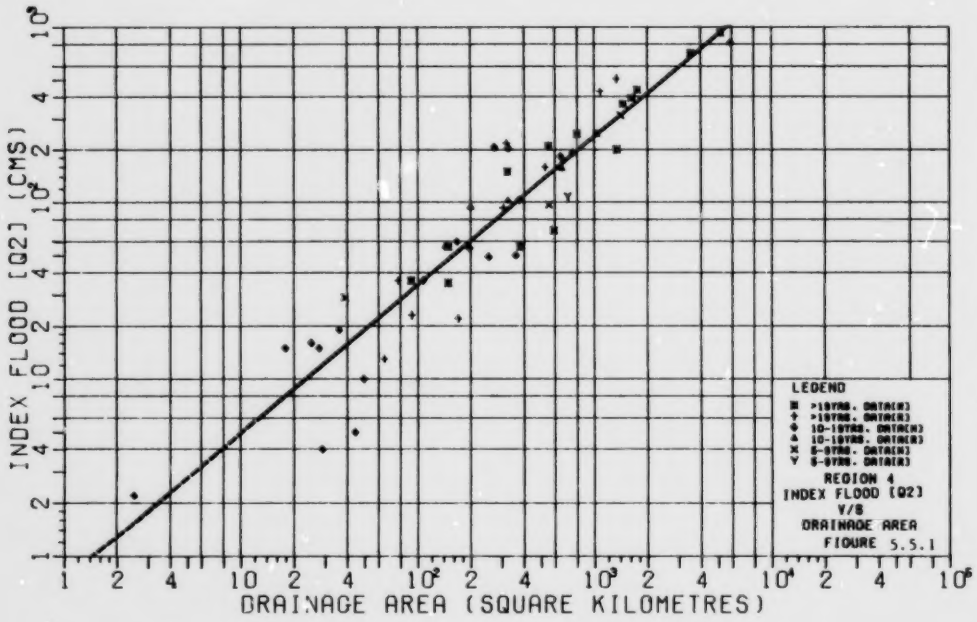

LEGEND:
Computed Frequency Curve
95% Confidence Limit Curves
95% Confidence Interval
RATIO TO INDEX FLOOD (Q2)
RECURRENCE INTERVAL IN YEARS
REGIONAL FREQUENCY CURVE FOR REGION 3

FIGURE 5.4.2


INDEX FLOOD (Q2) (CMS)
DRAINAGE AREA (SQUARE KILOMETRES)
LEGEND
REGION 4
INDEX FLOOD (Q2)
V/S
DRAINAGE AREA
FIGURE 5.5.1

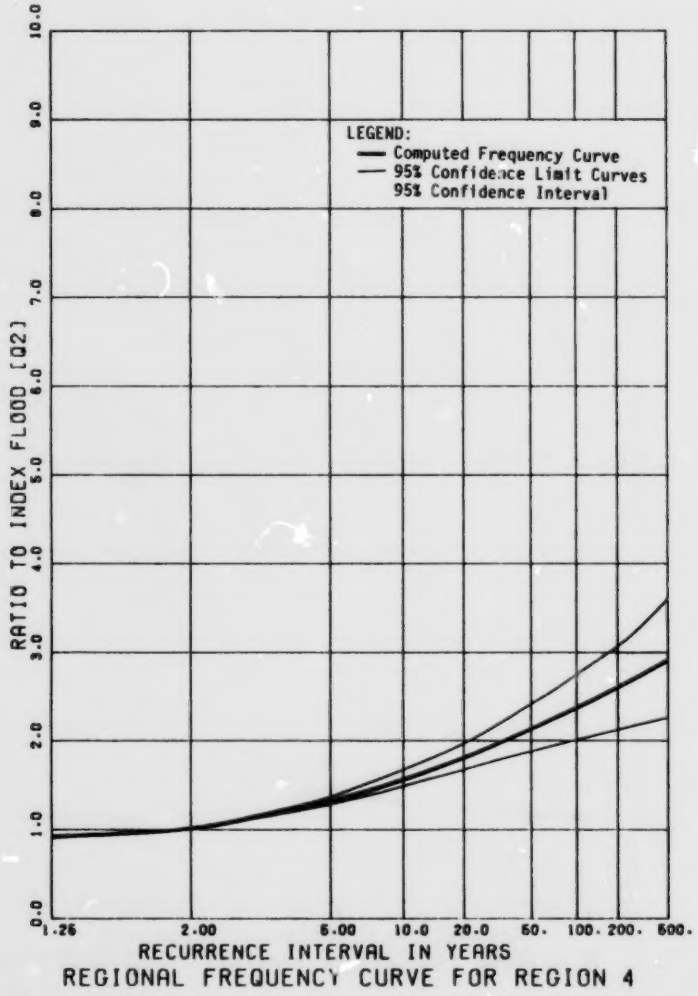
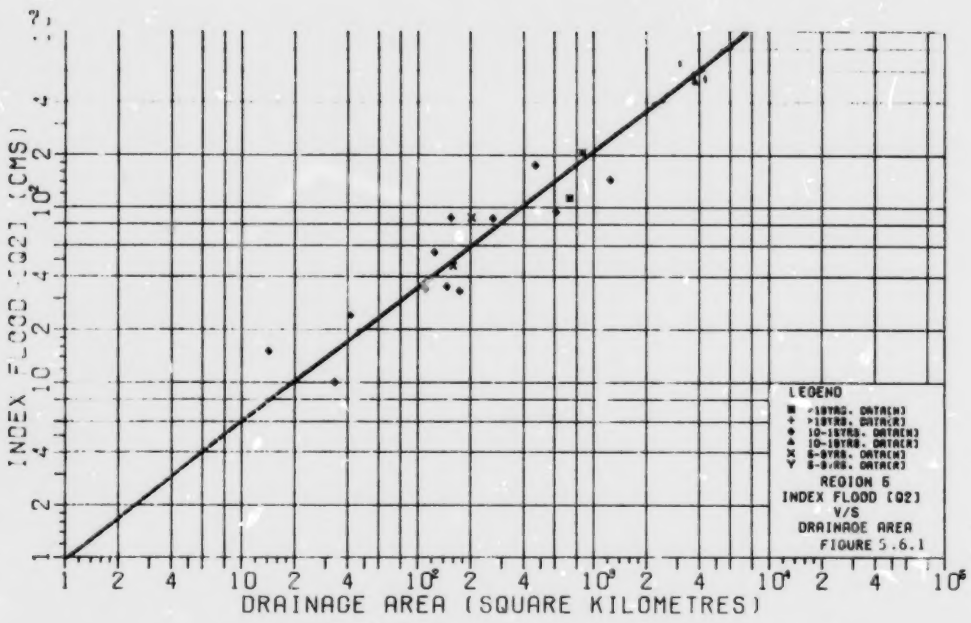

LEGEND:
Computed Frequency Curve
95% Confidence Limit Curves
95% Confidence Interval
RATIO TO INDEX FLOOD (Q2)
RECURRENCE INTERVAL IN YEARS
REGIONAL FREQUENCY CURVE FOR REGION 4

FIGURE 5.5.2


DRAINAGE AREA (SQUARE KILOMETRES)
LEGEND
REGION 6
INDEX FLOOD (Q2)
V/S
DRAINAGE AREA
FIGURE 5.6.1

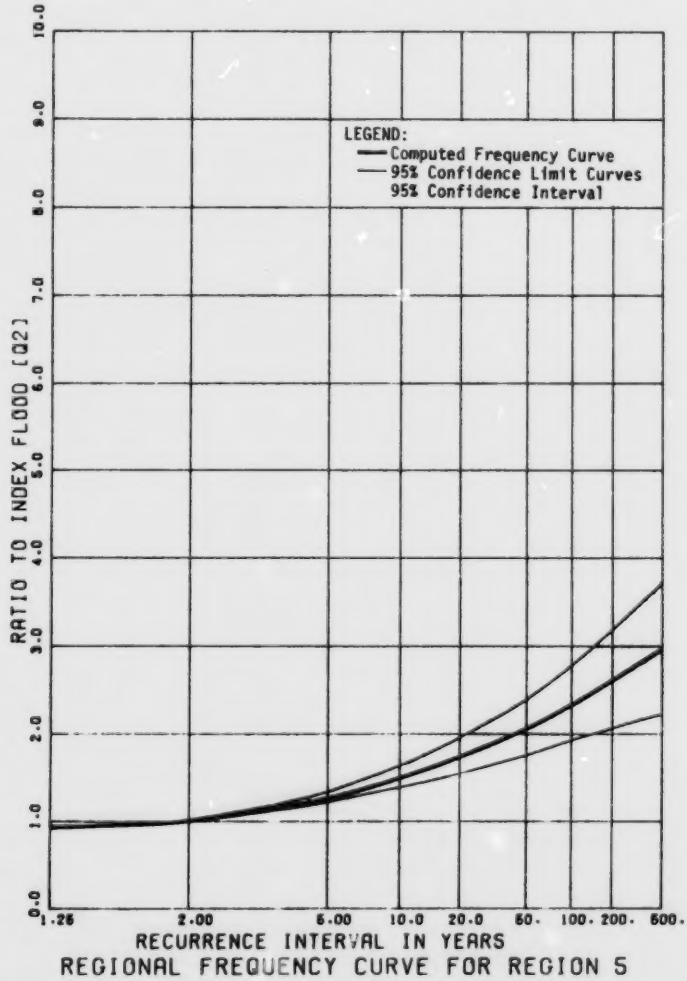
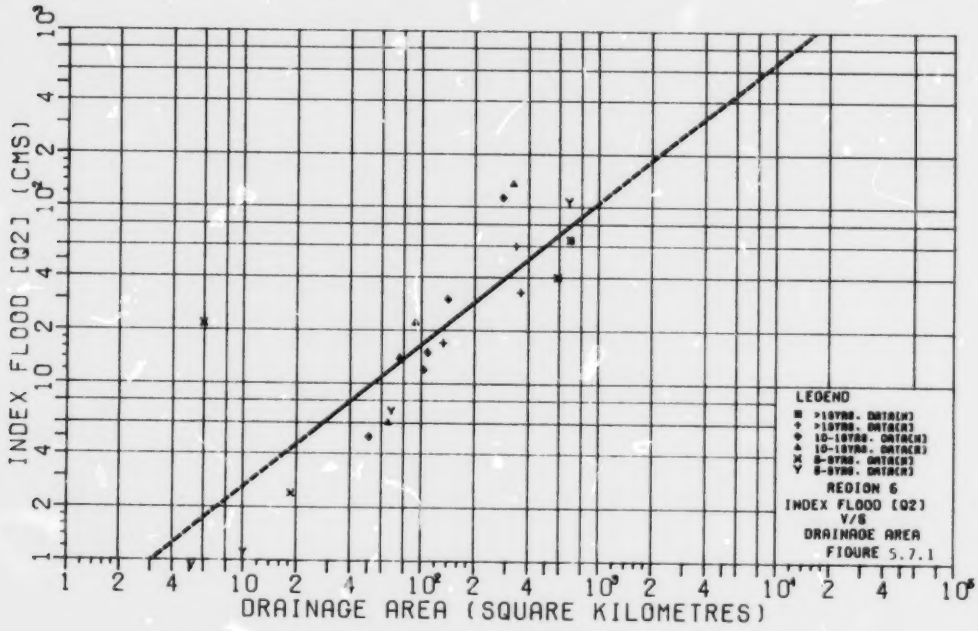

LEGEND:
Computed Frequency Curve
95% Confidence Limit Curves
95% Confidence Interval
RATIO TO INDEX FLOOD (Q2)
RECURRENCE INTERVAL IN YEARS
REGIONAL FREQUENCY CURVE FOR REGION 5

FIGURE 5.6.2


INDEX FLOOD [Q2] (CMS)
DRAINAGE AREA (SQUARE KILOMETRES)
LEGEND
REGION 6
INDEX FLOOD (Q2)
V/S
DRAINAGE AREA
FIGURE 5.7.1

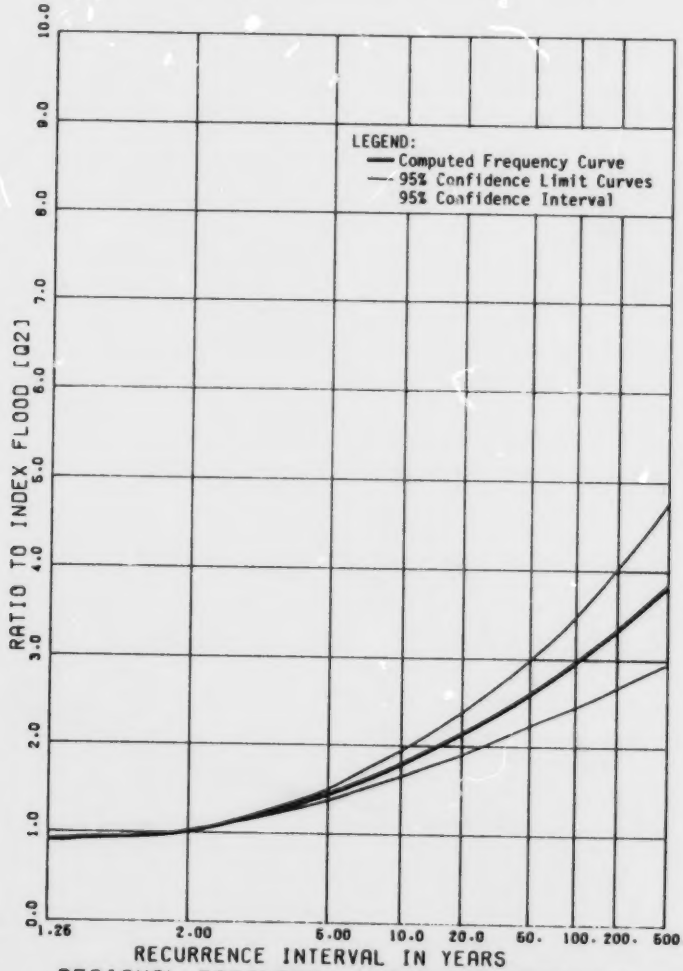
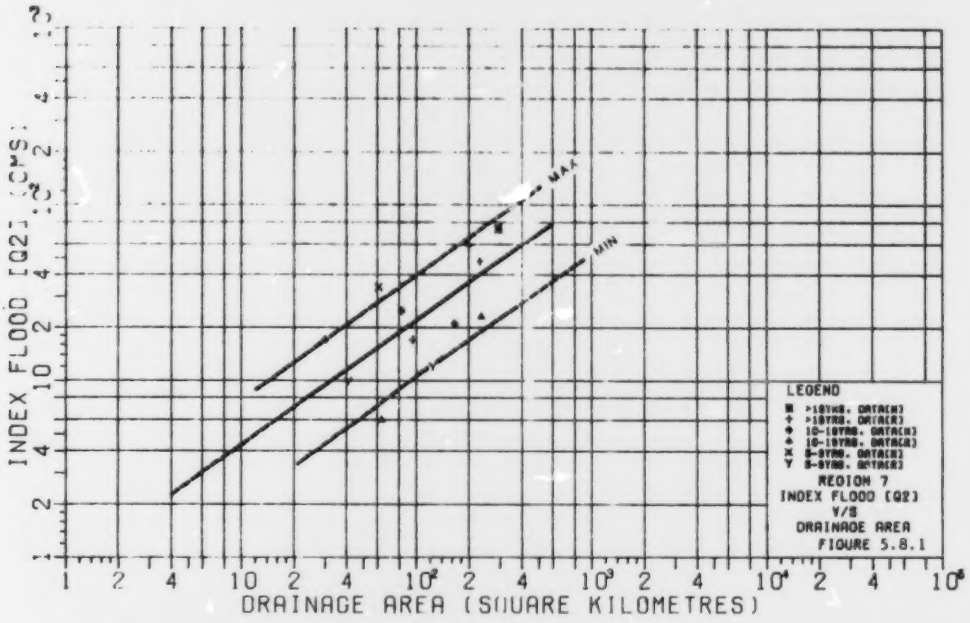

LEGEND:
Computed Frequency Curve
95% Confidence Limit Curves
95% Confidence Interval
RATIO TO INDEX FLOOD [Q2]
RECURRENCE INTERVAL IN YEARS
REGIONAL FREQUENCY CURVE FOR REGION 6

FIGURE 5.7.2


INDEX FLOOD (Q2) (CMS)
DRAINAGE AREA (SQUARE KILOMETRES)
MAX
MIN
LEGEND
REGION 7
INDEX FLOOD (Q2)
V/S
DRAINAGE AREA
FIGURE 5.8.1

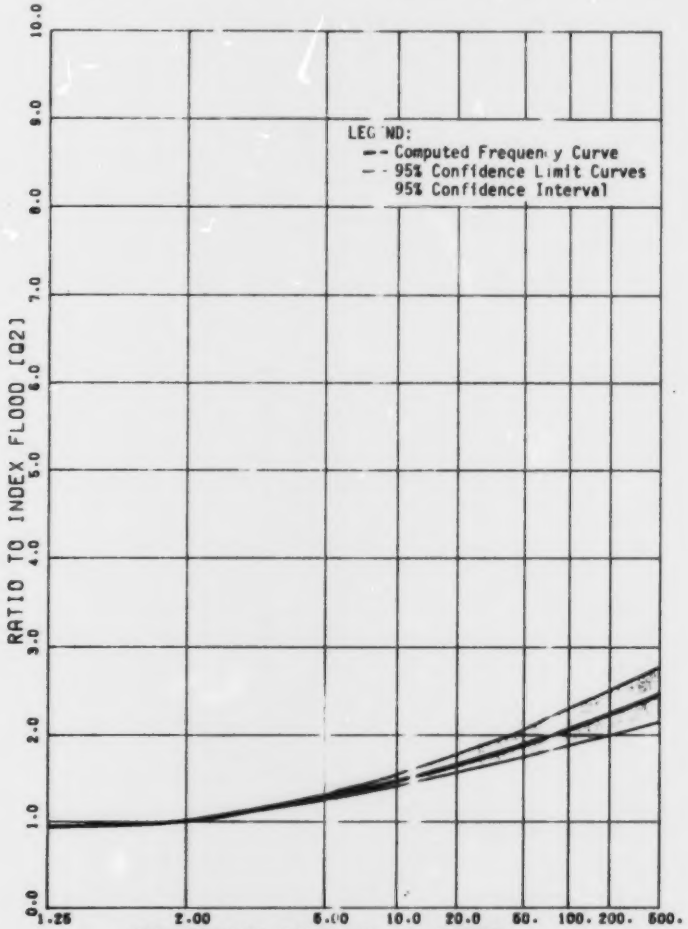
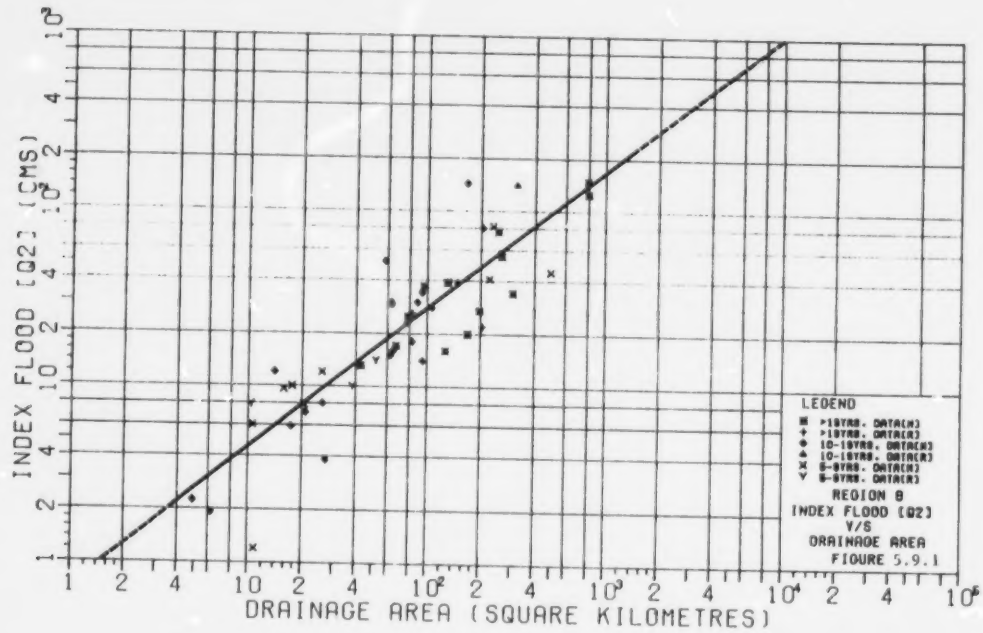
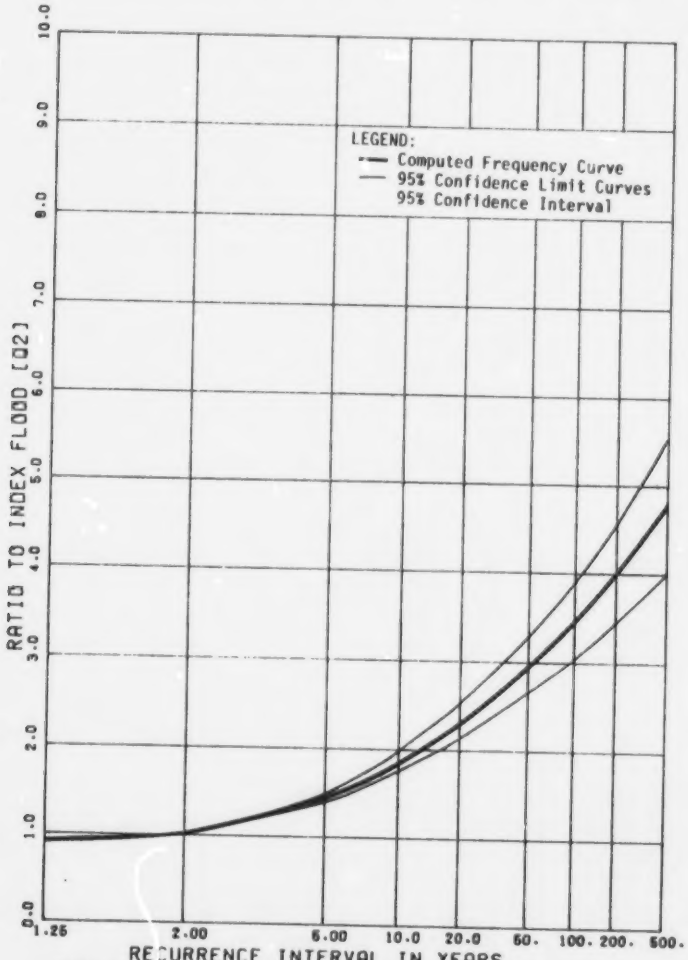

LEGEND:
Computed Frequency Curve
95% Confidence Limit Curves
95% Confidence Interval
RATIO TO INDEX FLOOD (Q2)
RECURRENCE INTERVAL IN YEARS
REGIONAL FREQUENCY CURVE FOR REGION 7

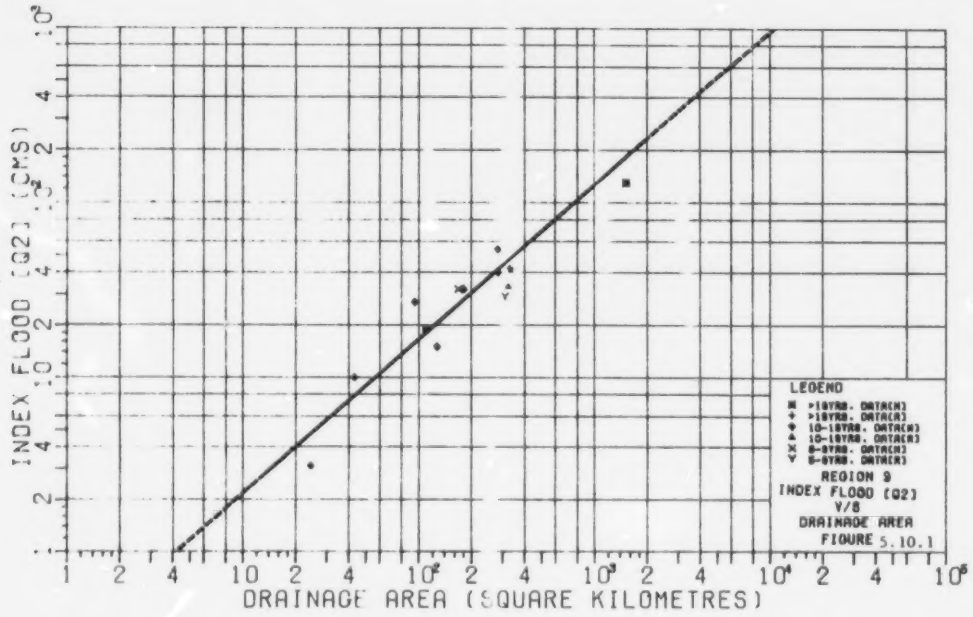
Figure 5.8.2





REGIONAL FREQUENCY CURVE FOR REGION 8

FIGURE 5.9.2


INDEX FLOOD (Q2) (CMS)
DRAINAGE AREA (SQUARE KILOMETRES)
LEGEND
REGION 9
INDEX FLOOD (Q2)
V/S
DRAINAGE AREA
FIGURE 5.10.1

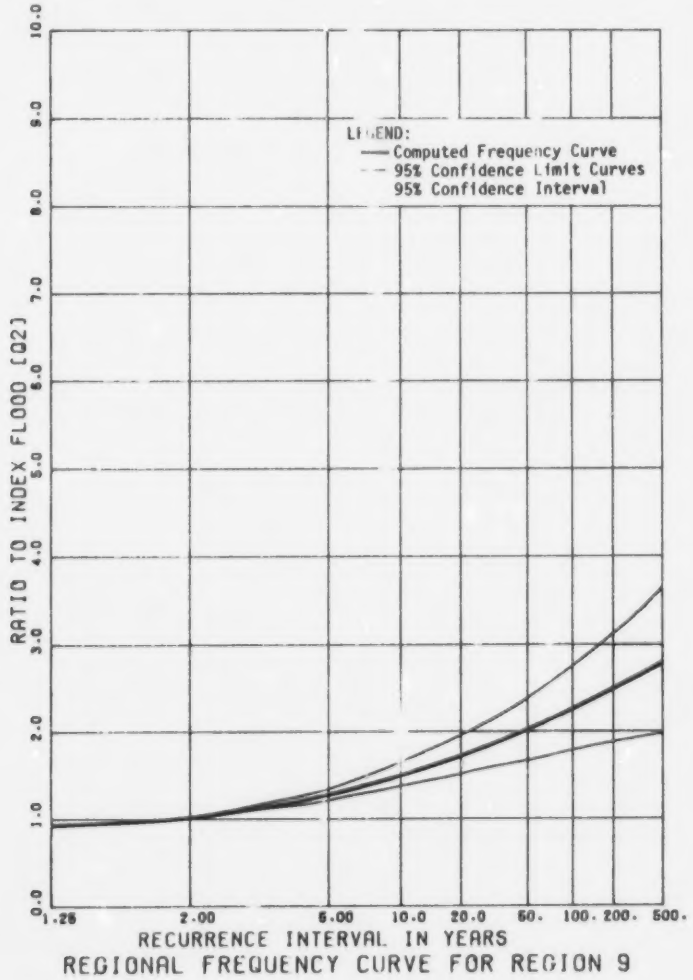
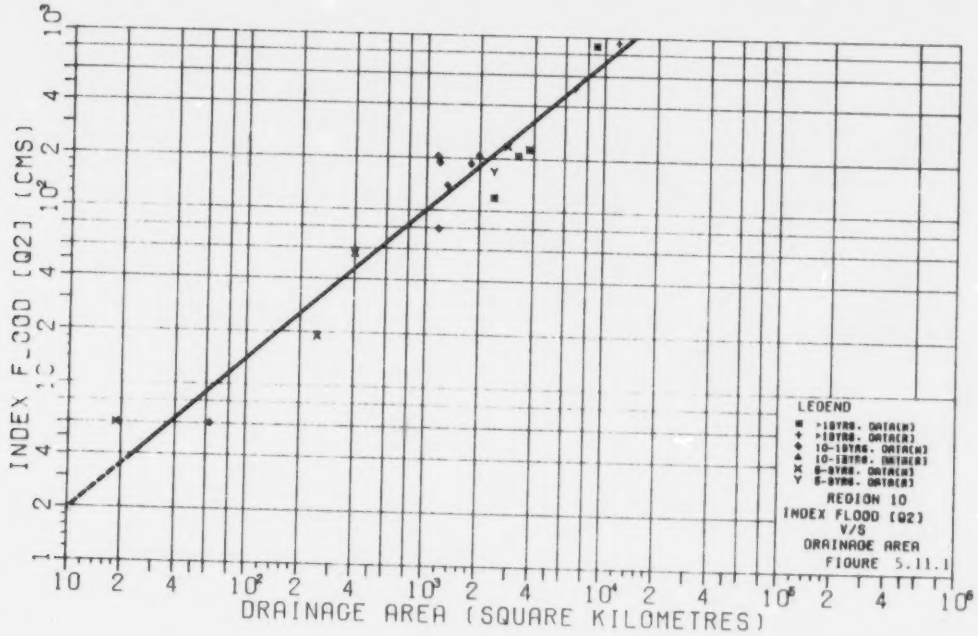

LEGEND:
Computed Frequency Curve
95% Confidence Limit Curves
95% Confidence Interval
RATIO TO INDEX FLOOD (Q2)
RECURRENCE INTERVAL IN YEARS
REGIONAL FREQUENCY CURVE FOR REGION 9

FIGURE 5.10.2


INDEX F-OOD (Q2) (CMS)
DRAINAGE AREA (SQUARE KILOMETRES)
LEGEND
REGION 10
INDEX FLOOD (Q2)
V/S
DRAINAGE AREA
FIGURE 5.11.1

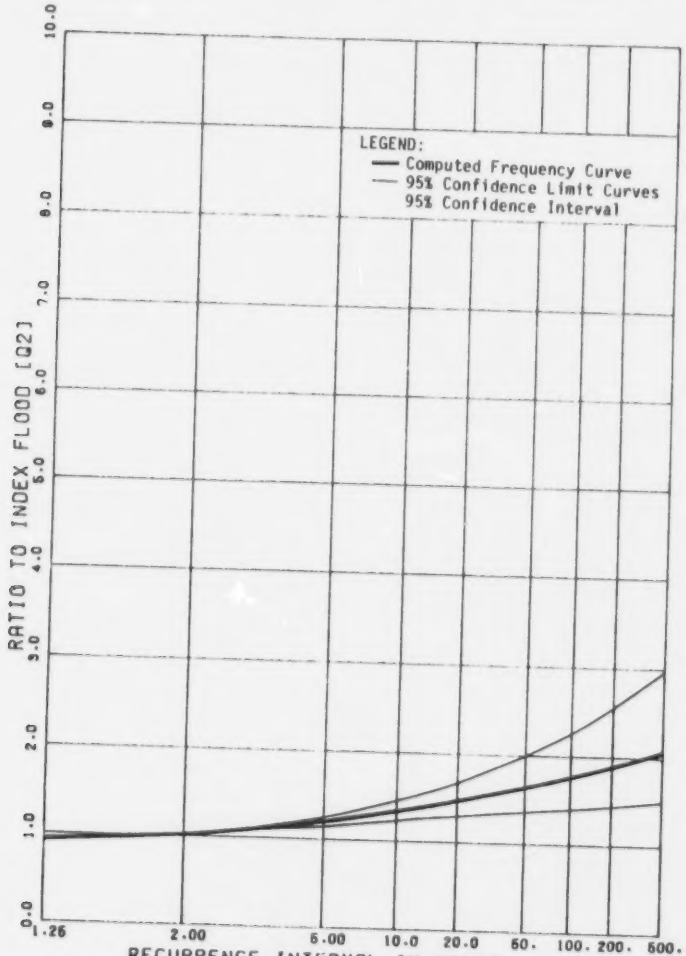
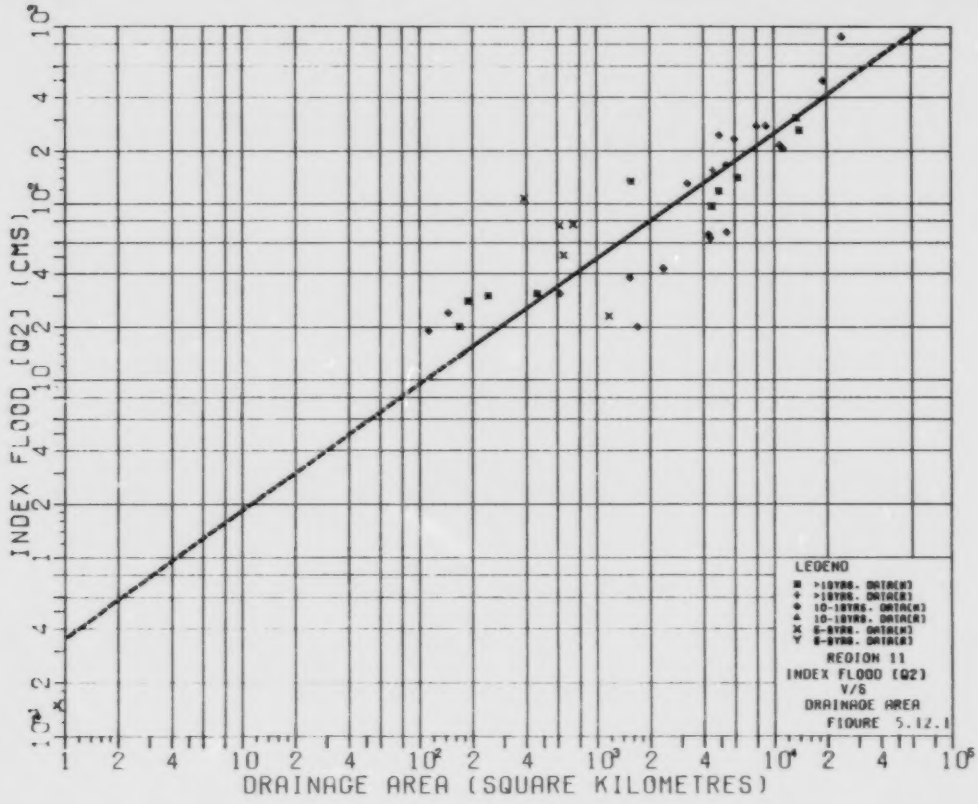
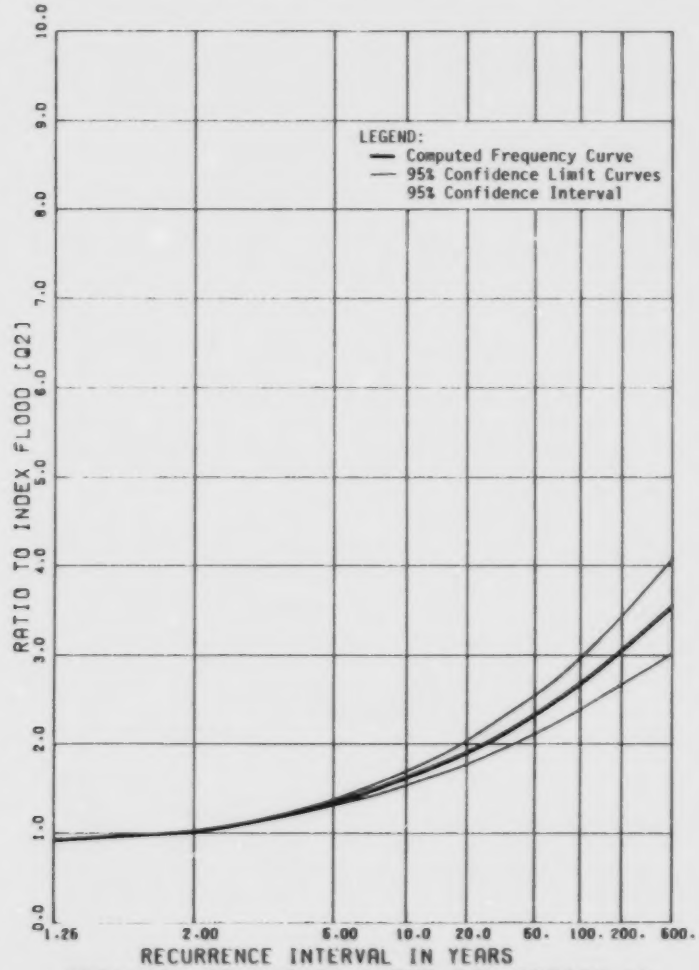

LEGEND:
Computed Frequency Curve
95% Confidence Limit Curves
95% Confidence Interval
RATIO TO INDEX FLOOD (Q2)
RECURRENCE INTERVAL IN YEARS
REGIONAL FREQUENCY CURVE FOR REGION 10

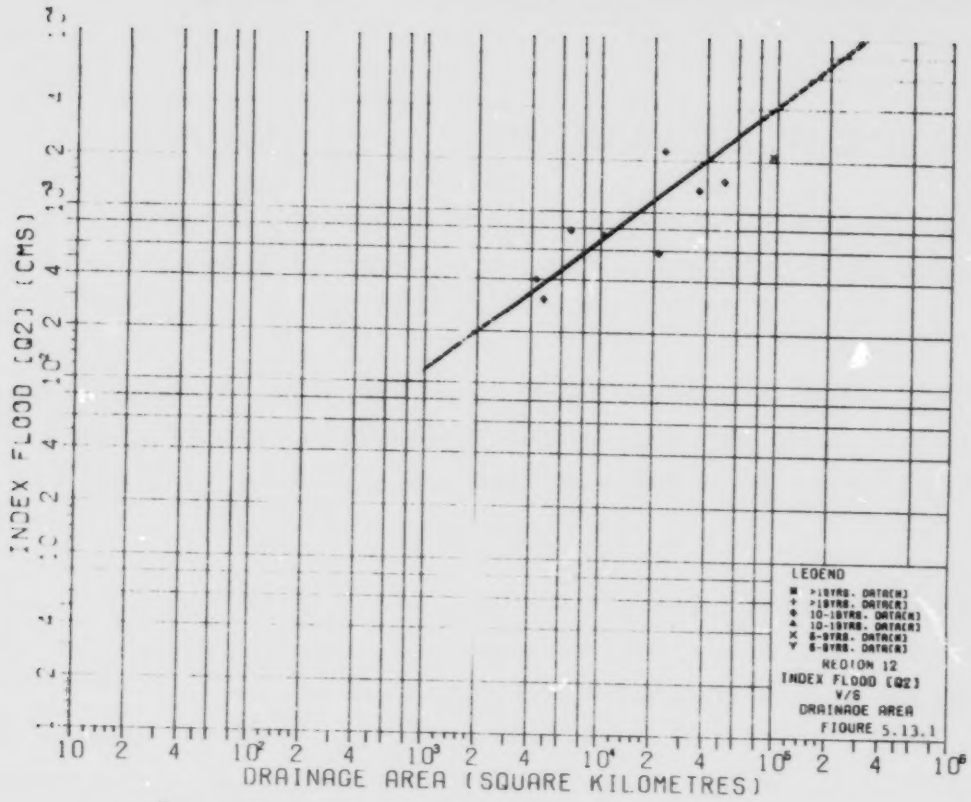
FIGURE 5.11.2

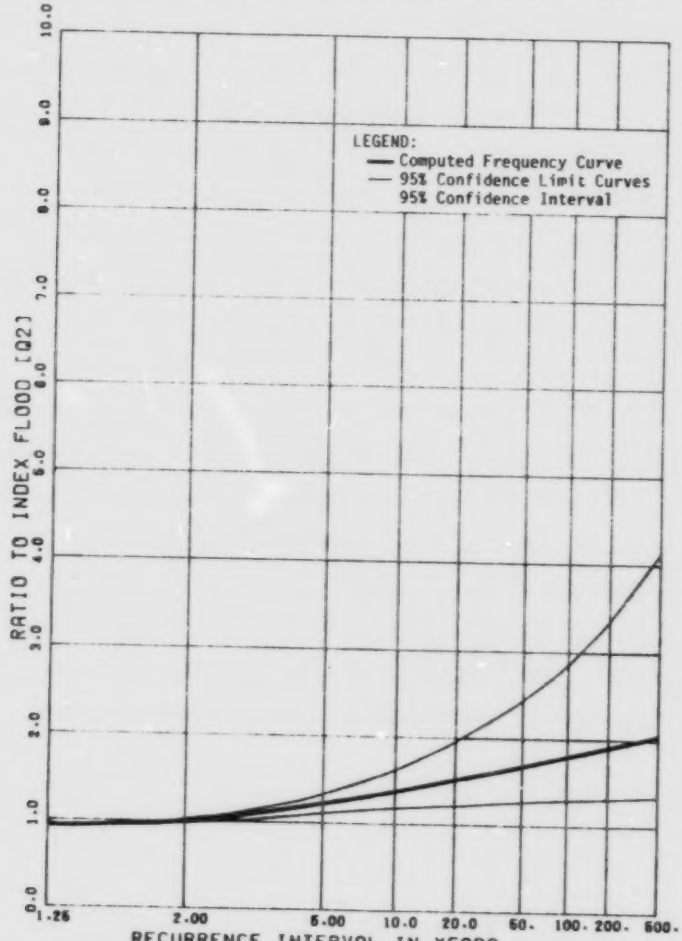




REGIONAL FREQUENCY CURVE FOR REGION 11

FIGURE 5.12.2





REGIONAL FREQUENCY CURVE FOR REGION 12

FIGURE 5.13.2

5.3 Testing of Index Flood Method

Once the two relationships yielding the index flood and the regional curve were developed, tests were carried out on the predictive capabilities of the equations and regional curve.

The tests were carried out on eleven stations in various regions. These stations were not used in developing the regional curve or in establishing the Q2 versus drainage area relationship. These stations are:

02BB003	Pie River near Marathon
02CD001	Serpent River at Highway 17
02ED004	Bailey Creek near Beaton
02FF003	Parkhill Creek near Parkhill
02GA029	Eramosa River above Guelph
02GC022*	Nanticoke Creek at Nanticoke
02GD009	Trout Creek near St. Marys
02HC026	West Duffins Creek at Green River
04FA002	Kawinogans River near Pickle Crow
04JD005	Pagwachuan River at Highway 11
04ME003*	Abitibi River at Onakawana

* Classified as having heavily regulated flow.

The results from the Index Flood Method were compared to the Single Station Frequency Analysis. When the tests were carried out, these eleven locations were treated as ungauged locations and the drainage areas were used in conjunction with the regional curves to estimate the various frequency flows.

Table 5.3.1 lists the results of the tests. The index flood was predicted by the method described in the previous section.

Comparison of flows for these stations indicate that, generally the regional relationships for the Index Flood Method gave predicted values which are quite reasonable except for Stations 02GA029 and 02FF003 when compared to those obtained by the Single Station Flood Frequency Analysis.

The test stations which predicted values that were significantly different from the Single Station Analysis were inspected and this indicated that these problems could be a result of inadequate length of data and or location of the station being close to an adjacent homogeneous region.

The standard error of estimate for equations in Region 4 and 5 are .31 and .21 in log units. When these are converted to an actual percentage for the upper and lower error range as discussed in Section 5.2 the standard error for the Q100 Region 4 relationship is -51% to +104% and for the Region 5 relationship this is -38% to +62%. The Region 4 station having the largest prediction error falls just outside the upper range and the other Region 5 Station (02FF003) severely under-predicts the flow. The latter station was not typical of the region as it fell way outside the 'bell' curve (used in the homogeneity test to define the region) when Q10/Q2 was subsequently plotted. A sample computation for one of the stations tested is presented in Appendix A16.

Table 5.3.1

Test of Regional Equations Used to Estimate Index Flood

Basic regional relationship:
Index Flood ($Q2$) = CA^n

Legend: N - natural data
R - regulated data
(25) - % error of predictions
*may not be typical of Region

SUMMARY OF RESULTS

Station No. (Region No.)	Actual Station Data: Drainage Area (km 2)	Years of Record	2 Year Flood (CMS)	Predicted Discharges and Errors (m^3/s): Q2	Q10	Q20	Q50	Q100
02BB003 (10)	4270	13 N	437	338(-23)	456(-27)	500(-28)	554(-26)	598(-27)
02CD001 (1)	1350	16 N	101	119(18)	170(23)	193(29)	221(34)	243(41)
02ED004 (3)	207	15 R1	24	33(37)	53(8)	62(6)	74(2)	84(0)
02FF003* (5)	124	14 N	55	42(-31)	48(-55)	73(-60)	86(-64)	98(-67)
02GA029 (4)	236	17 R2	29	71(144)	112(119)	129(113)	151(110)	168(105)
02GC022 (6)	181	11 R3	29	27(-7)	48(-4)	57(-4)	70(-6)	80(-8)
02GD009 (4)	140	19 N	45	46(1)	72(-24)	83(-30)	98(-36)	109(-40)
02HC026 (8)	98.1	19 N	26	26(0)	48(-16)	60(-16)	77(-16)	90(-17)
04JD005 (10)	2020	15 N	191	179(-6)	242(-4)	265(-2)	294(1)	317(4)
04FA002 (11)	1540	15 R2	61	68(11)	110(21)	135(33)	158(41)	181(52)
04ME003 (12)	27500	23 R3	1779	1469(-18)	1792(-40)	2027(-43)	2233(-50)	2468(-53)

5.4 Expected Probability Computations

Another feature of this study was the introduction of the expected probability concept in the regional analyses. The expected probability, Beard (1962) and average exceedence probability, Hardison and Jennings (1972), descriptions have been around for over twenty years but employed mainly in the design of hydraulic structures and in evaluating benefits and costs of projects during economic analysis.

Mathematically, the expected probability concept has a sound basis when applied in a regional sense. In a hydrologic homogeneous region, it is presumed that the frequency curves will have similar slopes. If the analysis is then carried out for 25 stations with an average of 20 years of record length, then the total length of the normalized record can be considered as 500 years long. Thus, there is an average probability that five of these events were equal to or exceeded the 1-in-100 year flood.

This argument is similar to the reasoning, that if 1,000 years of flood peaks are analyzed from a single population and grouped as 100 samples each 10 years long, then the mean of all the sample means is equal to the mean of the population.

The procedure is, unfortunately, not so well defined when this methodology is extended to the analysis of a single station. This stems from the fact that the averaging processes available in a regional sense are not available for a single station.

The Province of Ontario has adopted the policy whereby all frequency distributions will be adjusted for the expected probability computations. Consequently, in the present study, expected probability adjustments were made to all twelve regional index flood curves.

This technique was applied to all twelve regions. Tables 5.1.10 to 5.1.21 list the total years and average years of records used in developing the expected probability curves. For establishing these curves, the average record length was employed for generating the probabilities and hence the recurrence intervals for the following specific probabilities.

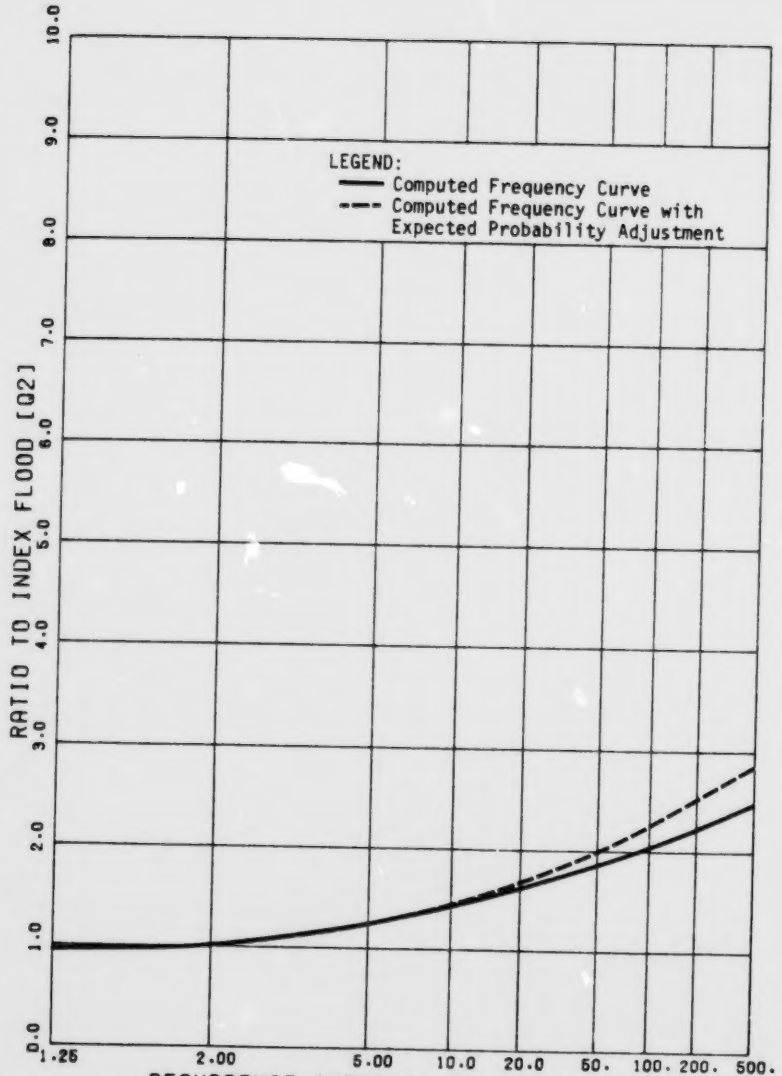
P(exceedence)	P(expected)
0.005	$0.005\ (1 + 52/N^{1.16})$
0.01	$0.01\ (1 + 26/N^{1.16})$
0.05	$0.05\ (1 + 6/N^{1.04})$
0.1	$0.1\ (1 + 3/N^{1.04})$
0.3	$0.3\ (1 + 0.46/N^{0.925})$

where N is the average number of years of data for the region.

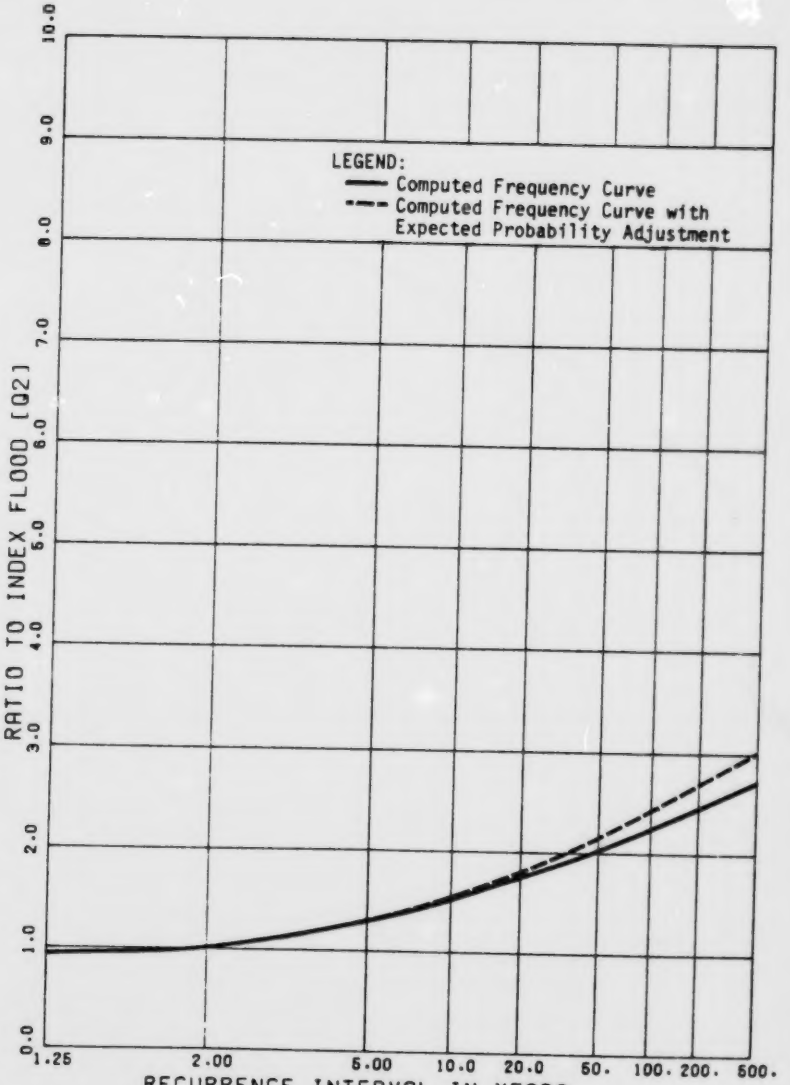
The computed expected probabilities associated with five recurrence intervals for the twelve regions are shown on Tables 5.1.10 to 5.1.21 along with other relevant data. Figures 5.14.1 to 5.14.12 present the effect of incorporating an expected probability on the regional curves. The regional curves rotate counter-clockwise about the two year return period or the index flood (ratio of 1.0).

As can be seen from these figures, the degree of rotation is proportional to the average number of years of record length, with the higher the number (of years of record) the smaller the rotation or deviation from the regional curve and vice-versa.

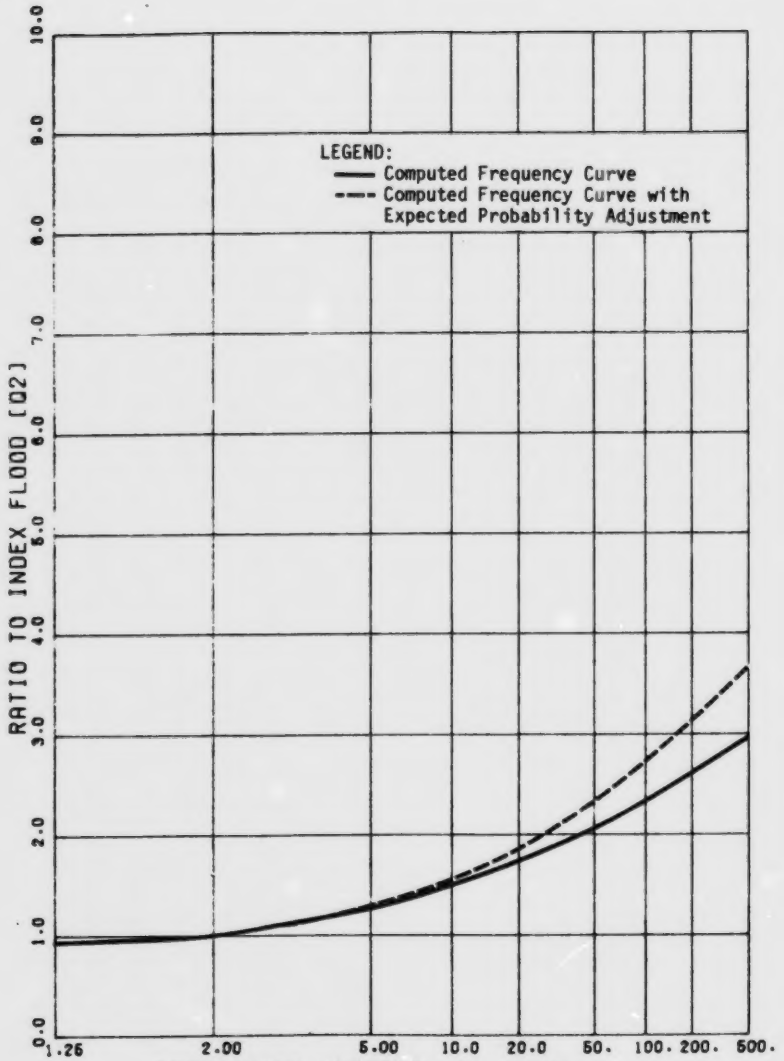
It may be of some interest to note that traditionally for the Index Flood Method, the median curve is plotted as the representative curve for the homogeneous region. If the number of stations forming a region is significant, it was found that the mean curve was slightly higher than the median curve. In many of the regions it was observed that these mean curves coincided with the curves adjusted for expected probability.



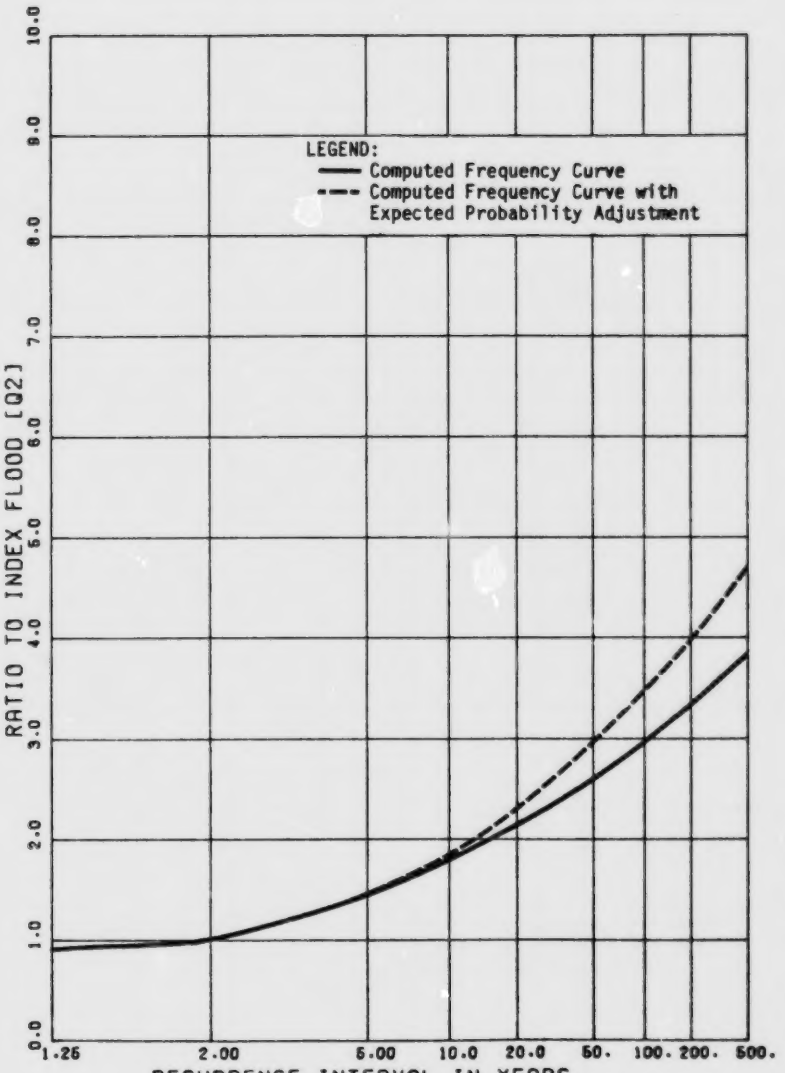
REGIONAL FREQUENCY CURVE FOR REGION 1
FIGURE 5.14.1



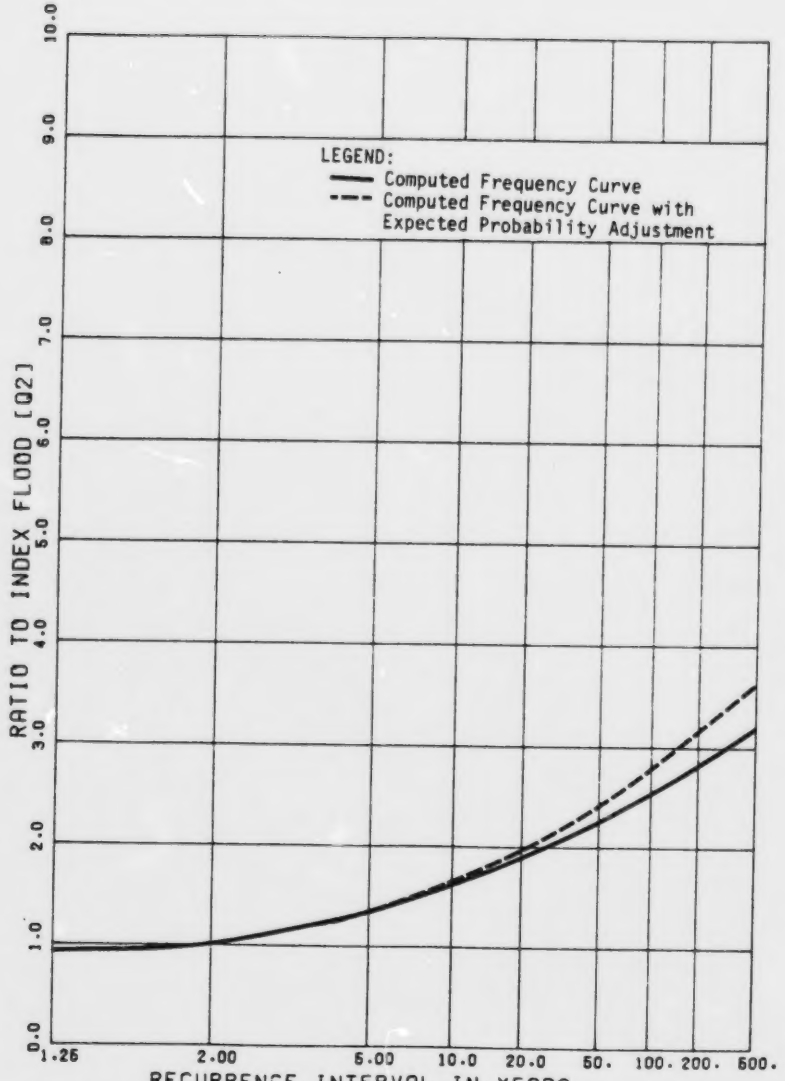
REGIONAL FREQUENCY CURVE FOR REGION 2
FIGURE 5.14.2



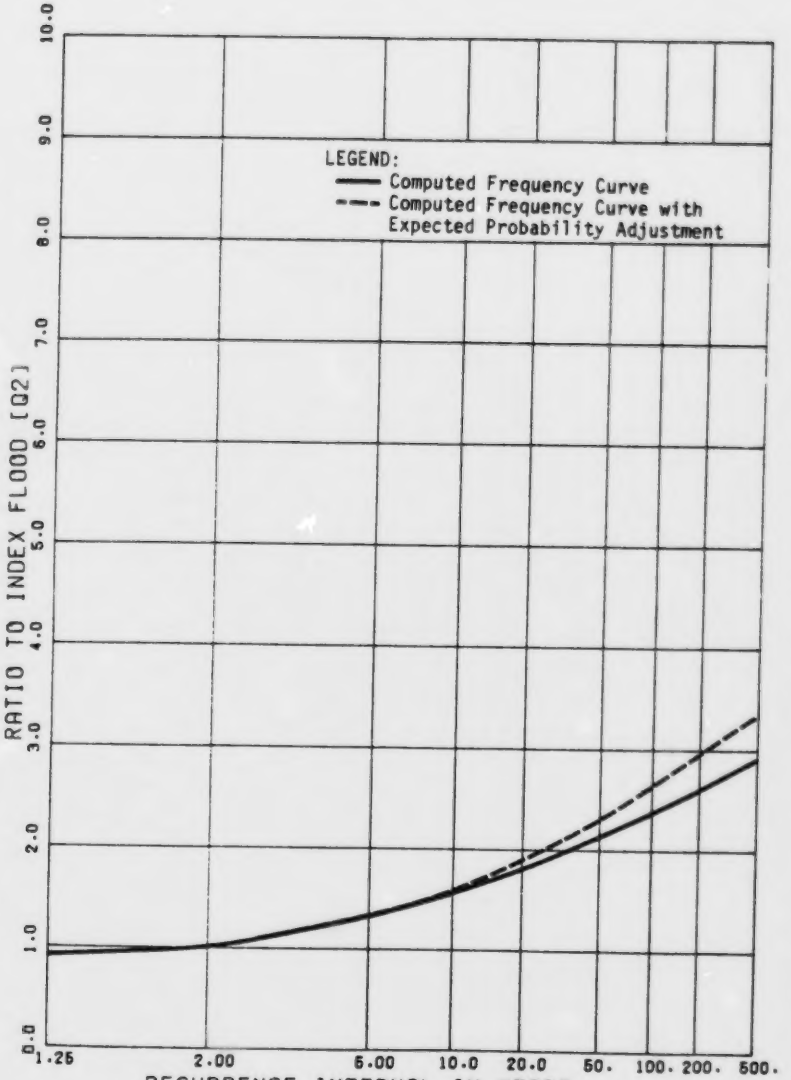
REGIONAL FREQUENCY CURVE FOR REGION 5
FIGURE 5.14.3



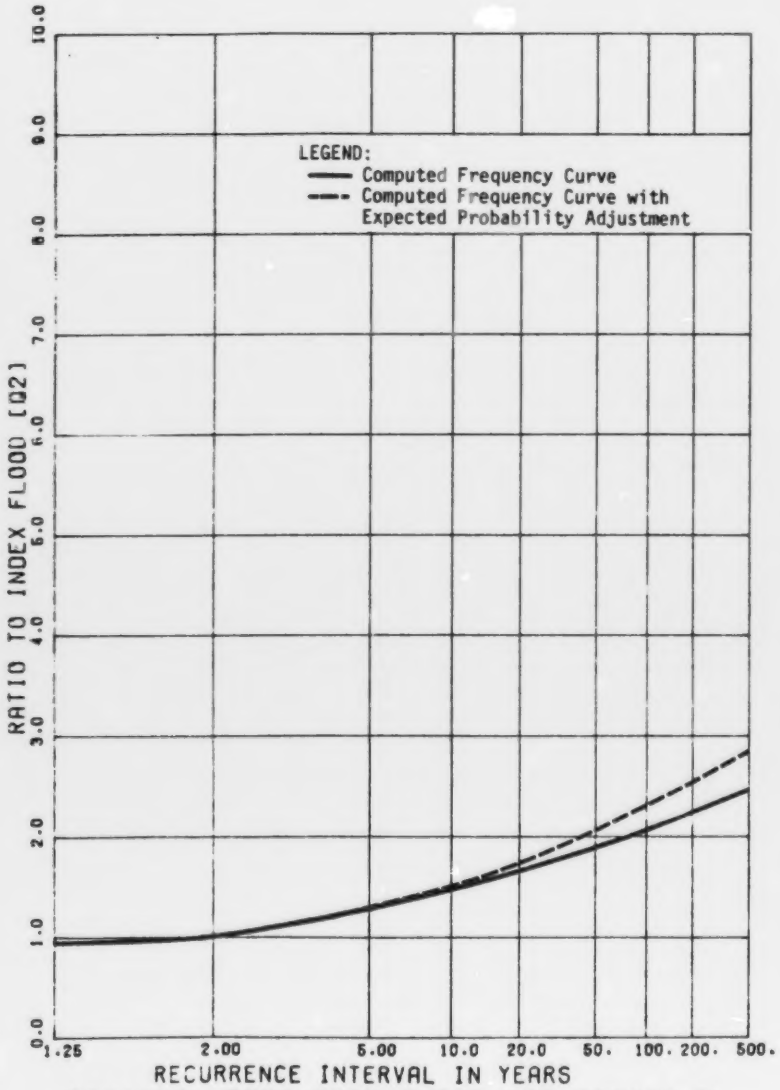
REGIONAL FREQUENCY CURVE FOR REGION 6
FIGURE 5.14.4



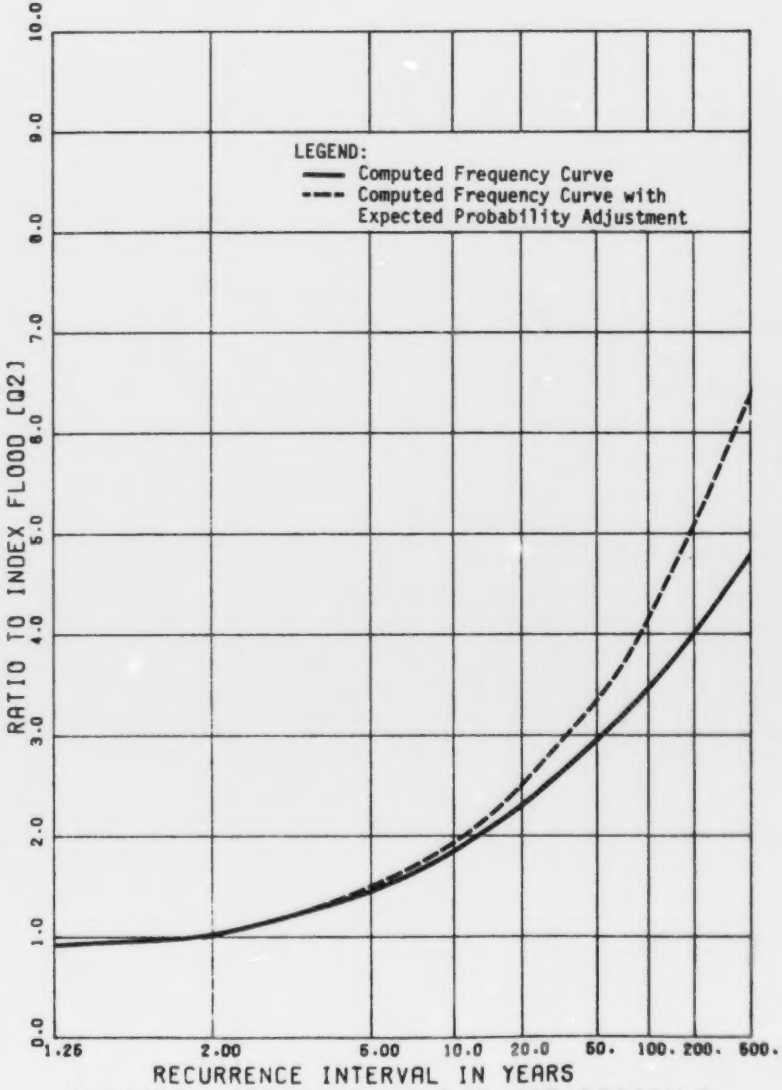
REGIONAL FREQUENCY CURVE FOR REGION 3
FIGURE 5.14.5



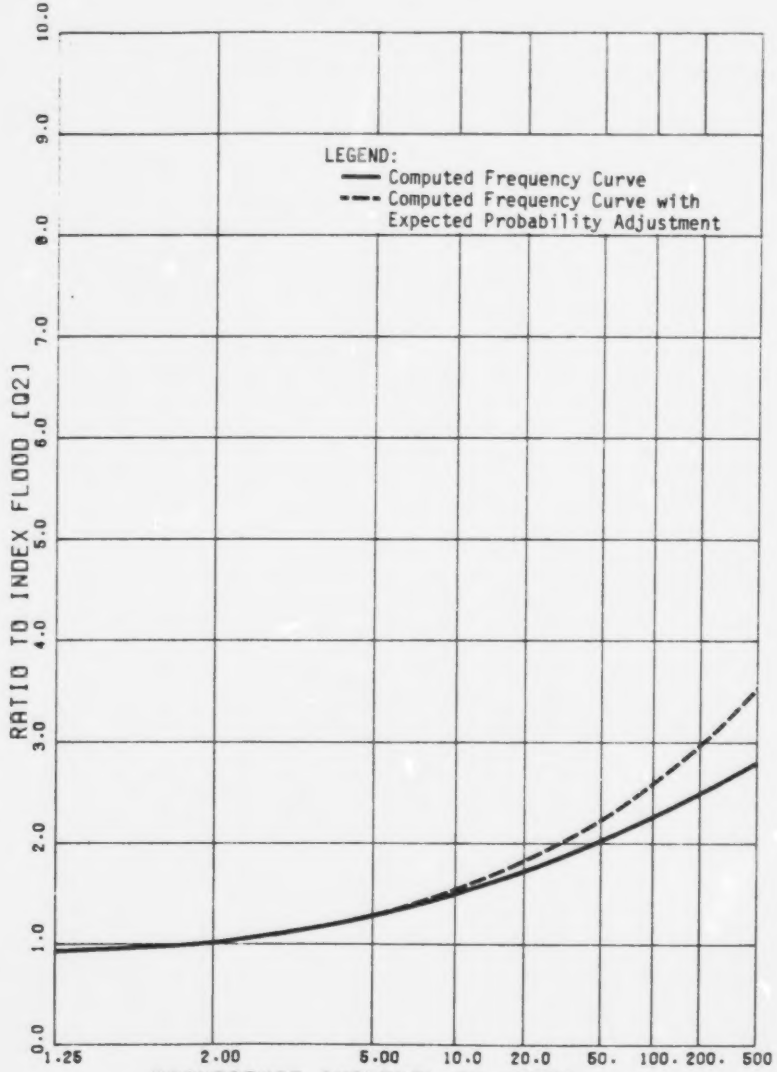
REGIONAL FREQUENCY CURVE FOR REGION 4
FIGURE 5.14.6



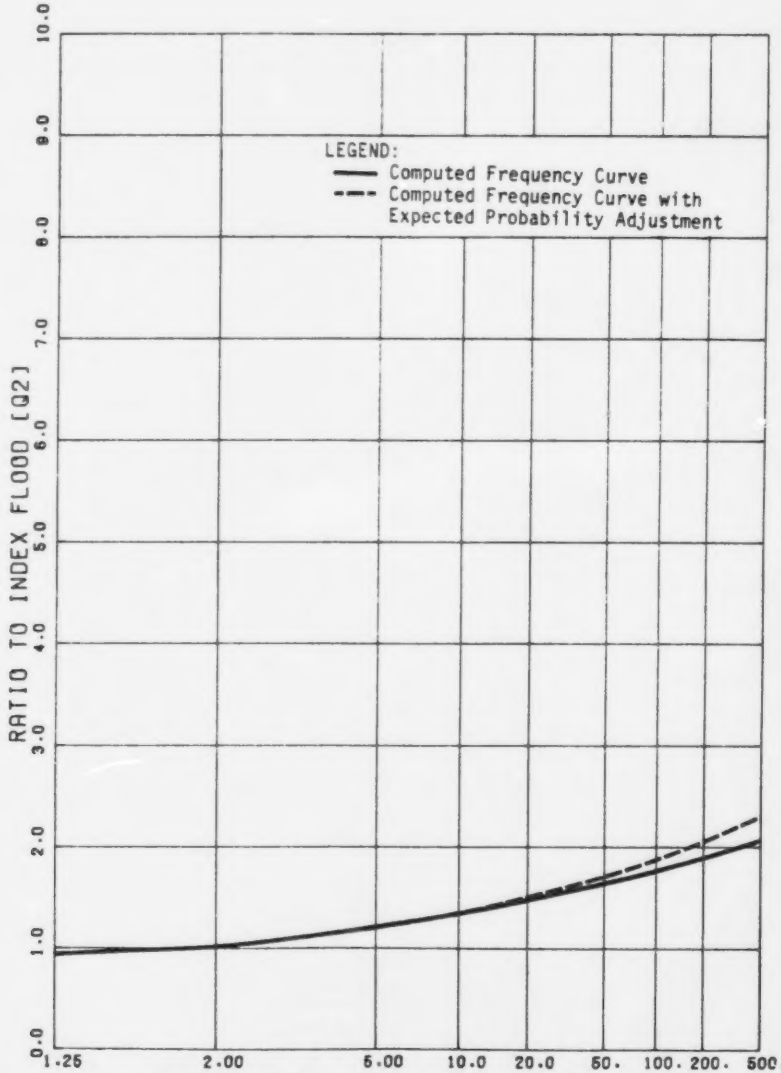
REGIONAL FREQUENCY CURVE FOR REGION 7
FIGURE 5.14.7



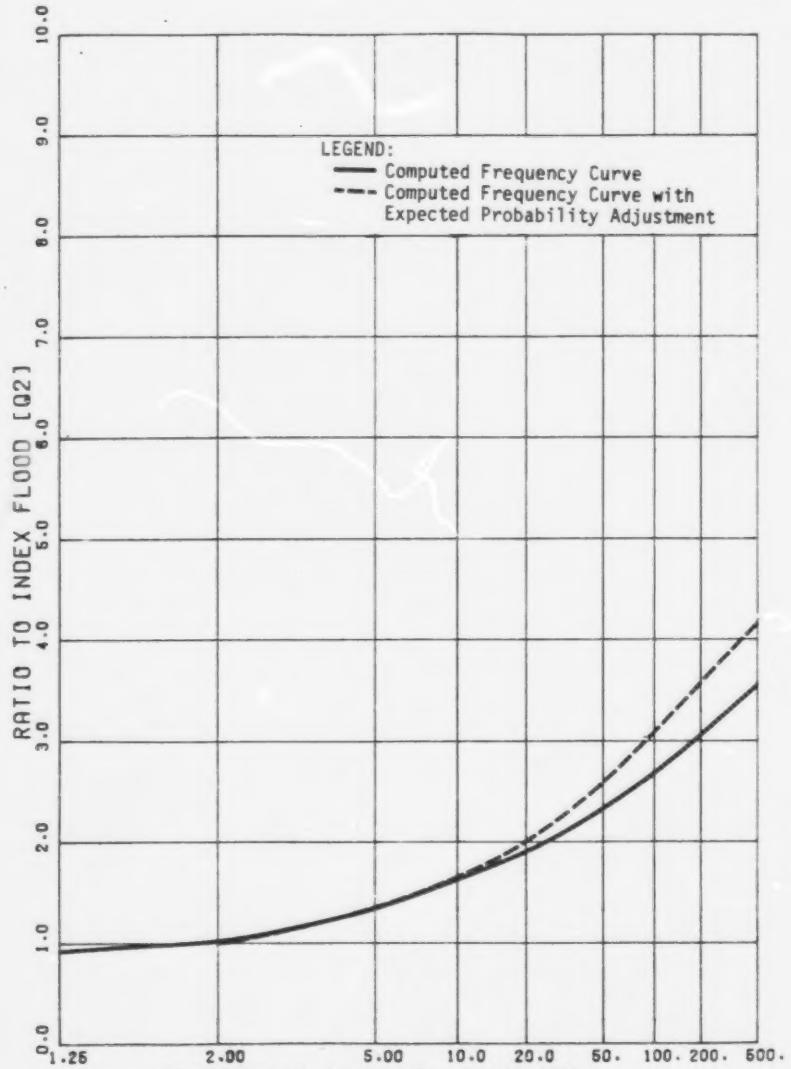
REGIONAL FREQUENCY CURVE FOR REGION 8
FIGURE 5.14.8



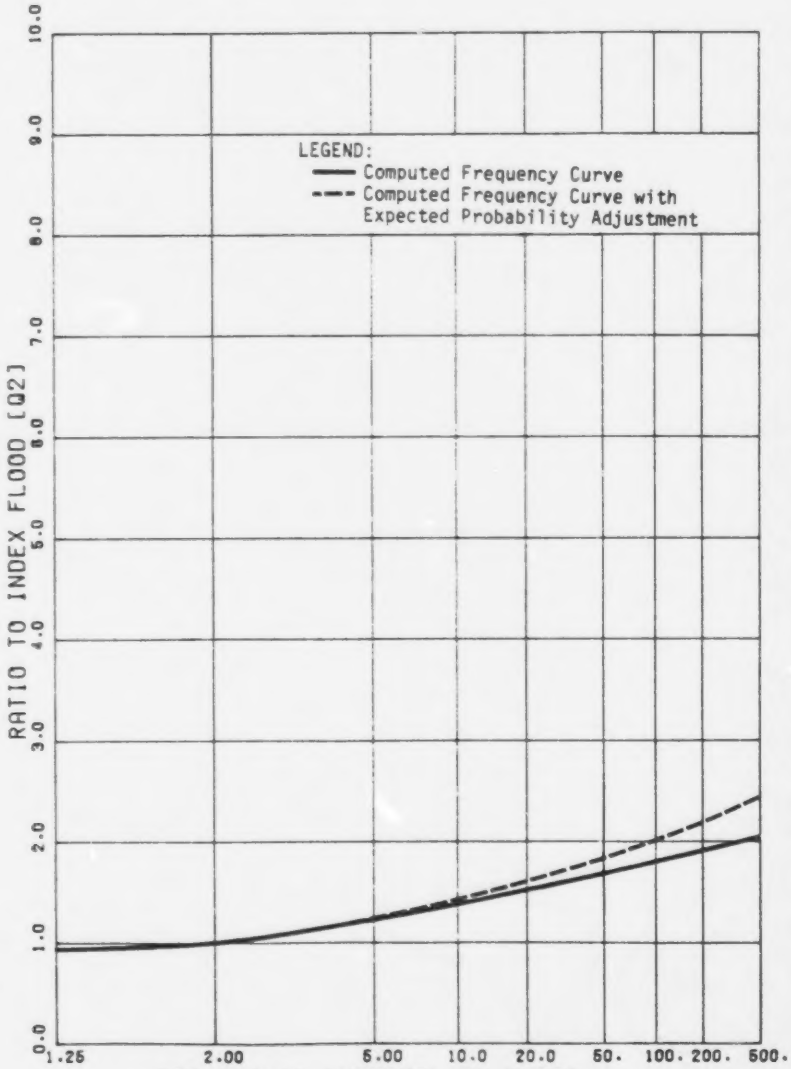
REGIONAL FREQUENCY CURVE FOR REGION 9
FIGURE 5.14.9



REGIONAL FREQUENCY CURVE FOR REGION 10
FIGURE 5.14.10



REGIONAL FREQUENCY CURVE FOR REGION 11
FIGURE 5.14.11



REGIONAL FREQUENCY CURVE FOR REGION 12
FIGURE 5.14.12

No computational adjustments were made to any of the single station frequency curves. Expected probability adjustments to the individual curves can be easily made by examining the length of record for the stations and rotating the curve about the 1-in-2 year flood value, counter-clockwise based on the relationship given above.

To employ the expected probability methodology in developing the design flows, for an ungauged watershed, the procedure is:

1) evaluate the mean annual flood
2) for the region, choose the frequency factors now based on the expected probability curve
3) obtain the various T-year floods by multiplying Q2 with the frequency factors.

For example, for an ungauged watershed with an area of, 212 sq. km. and located in Region 3, the Q2 is 34 m^3/s; the regional curve adjusted for the expected probability indicates ratios for the 1-in-100 year as 2.82 and 1-in-50 year as 2.40. Therefore the flood estimates for the two floods are 95.9 m^3/s and 81.6 m^3/s respectively. This is in contrast to the estimates of 86.3 m^3/s and 76.5 m^3/s without regard to the expected probability computations.

5.5 Recommended Flood Flow Estimation Procedure

The recommended procedure to follow when flood flow estimates are required at a given location on a water course is shown schematically in Figure 5.15.1. The necessary steps to follow when using the Index Flood Method of Regional Flood Frequency Analysis are shown in the following section.

A recommended method of pro rating flood flows for use in similar watersheds having drainage areas within 25% will be described. This method is also recommended in another study, Cumming-Cockburn (1985).

Estimates of flood flows are made using FFA and RFFA methods as appropriate.

$$QTV = \frac{QT \quad X \quad QTRU}{QTR}$$

where: QTU = estimate of T - year flood flow at point of interest

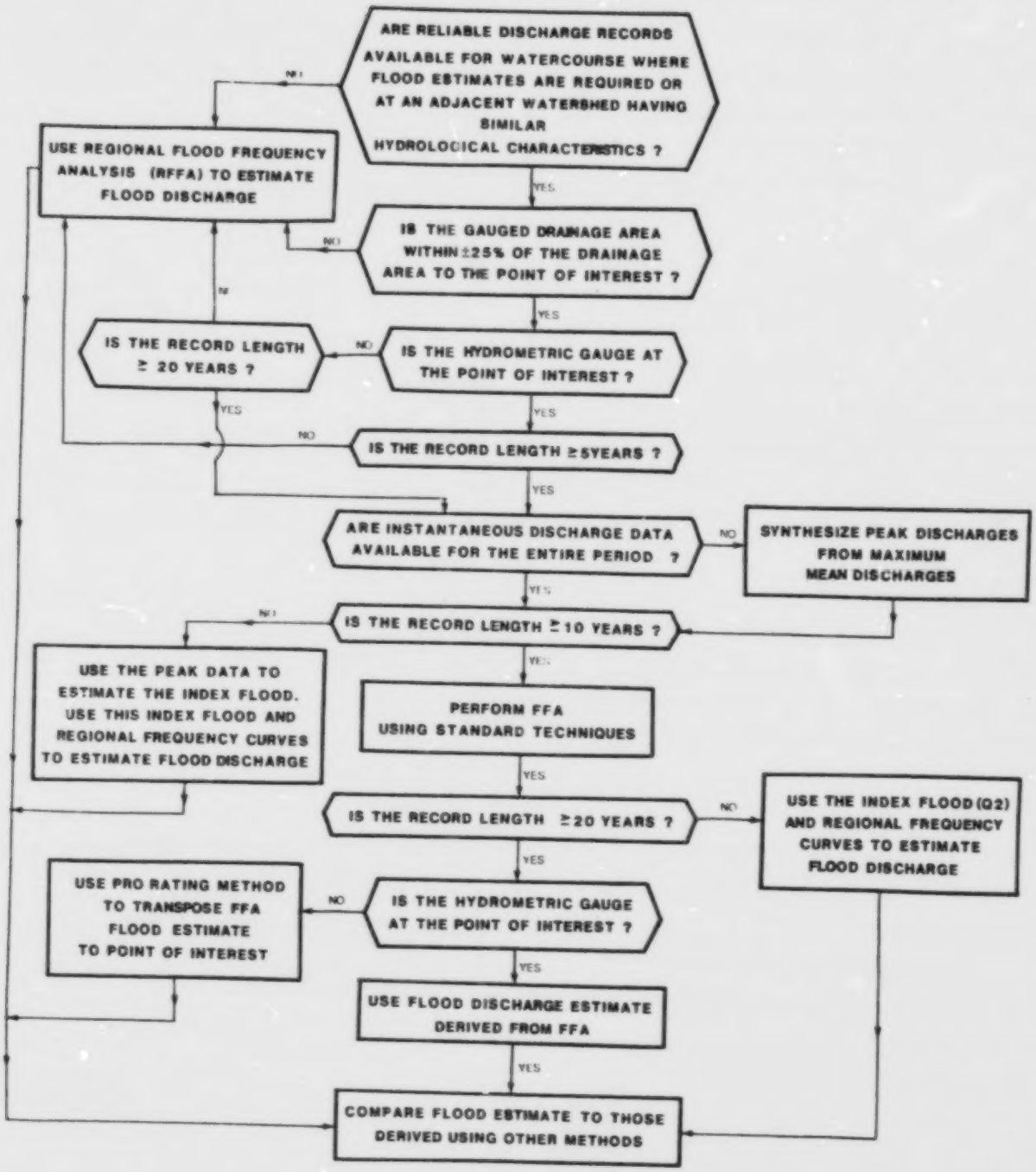
QT = estimate of T - year flood flow at adjacent gauge using FFA

QTR = estimate of T - year flood flow at adjacent gauge using RFFA

QTRU = estimate of T - year flood flow at point of interest using RFFA

5.6 Application of Regional Relationships - Index Flood Method

As previously discussed, Regional Flood Frequency Analysis is used to estimate flows for various return period floods in ungauged watersheds or in watersheds where insufficient or inadequate flow records exist and it is not possible to satisfactorily carry out a Single Station Flood Frequency Analysis on the available data.


ARE RELIABLE DISCHARGE RECORDS AVAILABLE FOR WATERCOURSE WHERE FLOOD ESTIMATES ARE REQUIRED OR AT AN ADJACENT WATERSHED HAVING SIMILAR HYDROLOGICAL CHARACTERISTICS ?
NO
YES
USE REGIONAL FLOOD FREQUENCY ANALYSIS (RFFA) TO ESTIMATE FLOOD DISCHARGE
IS THE GAUGED DRAINAGE AREA WITHIN ±25% OF THE DRAINAGE AREA TO THE POINT OF INTEREST ?
NO
YES
IS THE RECORD LENGTH ≥ 20 YEARS ?
NO
IS THE HYDROMETRIC GAUGE AT THE POINT OF INTEREST ?
YES
YES
NO
IS THE RECORD LENGTH ≥ 5YEARS ?
YES
ARE INSTANTANEOUS DISCHARGE DATA AVAILABLE FOR THE ENTIRE PERIOD ?
NO
SYNTHESIZE PEAK DISCHARGES FROM MAXIMUM MEAN DISCHARGES
YES
NO
IS THE RECORD LENGTH ≥ 10 YEARS ?
USE THE PEAK DATA TO ESTIMATE THE INDEX FLOOD. USE THIS INDEX FLOOD AND REGIONAL FREQUENCY CURVES TO ESTIMATE FLOOD DISCHARGE
YES
PERFORM FFA USING STANDARD TECHNIQUES
YES
IS THE RECORD LENGTH ≥ 20 YEARS ?
NO
USE THE INDEX FLOOD (Q2) AND REGIONAL FREQUENCY CURVES TO ESTIMATE FLOOD DISCHARGE
YES
USE PRO RATING METHOD TO TRANSPOSE FFA FLOOD ESTIMATE TO POINT OF INTEREST
NO
IS THE HYDROMETRIC GAUGE AT THE POINT OF INTEREST ?
YES
USE FLOOD DISCHARGE ESTIMATE DERIVED FROM FFA
YES
COMPARE FLOOD ESTIMATE TO THOSE DERIVED USING OTHER METHODS

PROCEDURE FOR ESTIMATING FLOOD DISCHARGES

INDEX METHOD

FIGURE 5.15.1

Eleven stations were omitted from the data used in the RFFA to develop regional relationships as discussed in Section 5.2 in order to compare the flow estimates derived from the index method to those derived from FFA. One of the omitted stations, West Duffins Creek at Green River (02HC026) will be assumed as ungauged for use as an example in the following. The procedures described in steps 1 through 7 are employed to estimate flood flows at various return periods using the index method.

Step 1

Measure the watershed area contributing to flow at the location in question.

Example: Drainage area = 98.1 km^2

Step 2

Determine the region in which the watershed is located by reference to Figure 5.1.1.

Example: Region 8

Step 3

Verify that the drainage area is within the range used to derive regional relationships - if not continue with caution and verify the end result using another technique.

Example: OK

Step 4

Refer to Table 5.1.1 for the appropriate regional equation or to the appropriate plots of index flood versus drainage area (Figures 5.2.1 - 5.13.1) and estimate the index flood (Q2) using the drainage area determined in Step 1.

Example: index flood (Q2) = 26 m^3/s

Step 5

Refer to the appropriate dimensionless frequency curve for the region shown in Figures 5.2.2 - 5.13.2 (Figures 5.14.1 - 5.14.2, if the Expected Probability Adjustment is used) and extract the ratio corresponding to the return period for the desired flood flow estimate.

Example: dimensionless frequency ratios (Station 02HC026)

Return Period (years)	5	10	20	50	100
Ratio to Index Flood (RF)	1.43	1.85	2.30	2.96	3.46
*Adjusted RF	1.50	1.99	2.55	3.40	4.10

Note: When using above mentioned tables, use values computed with all data used for the region included.

*Denotes ratio with Expected Probability Adjustment.

Step 6

Compute the desired return period flood flow estimate as the product of the index flood estimate (Step 4) and the appropriate dimensionless frequency ratio derived from Step 5.

Example: RFFA flood flow estimates (Station 02HC026)

Return Period (years)	5	10	20	50	100
Flood Flow Estimate (QTE) (m^3/s)	37	48	60	77	90
*Adjusted QTE	39	52	66	88	107

*Denotes flow computed using frequency ratios with Expected Probability Adjustment.

Step 7

Verify the above estimate using other techniques. If the station is located at or close to the boundary of a region, check the flow estimate using the regional relationships for the adjacent region.

Example: FFA estimates shown below:

Return Period (years)	2	5	10	20	50	100
Flood Flow Estimate (m^3/s)	26	44	57	71	92	109

The standard error of estimate of the flow computed in Step 6 may be determined for the 100-year estimate using the relationships derived in Section 5.2 as follows:

$$SE = 0.27 \text{ (from Table 5.2.1) in log units}$$
$$TE = 10^{.27}$$
$$= 1.86$$
$$Se_U = (1.86-1) \times 100$$
$$= 86\%$$
$$Se_L = (1-1/1.86) \times 100$$
$$= 46\%$$

ie. the actual value would be expected to lie in the range of -46% to 86% of the predicted value if the drainage basin is typical of the region.

5.7 Summary of Results and Conclusions

Index method relationships were established for twelve homogenous regions in the Province of Ontario using the methodology described in Section 5.1. In decreasing order of performance, the regions based on the homogeneity test for station data falling within the 95% confidence intervals (bell curves) were as follows: Regions 3, 7, 11, 5, 1, 6, 8, 4, 12, 10, 9 and 2.

As noted in Table 5.2.1, Region 12 had the least number of station years of data used for the analysis, closely followed by Regions 7 and 2 while Region 4 had the most. The mean values of the coefficients of skew and kurtosis for the fitted distributions ranged from -0.01 to -0.07 and 3.2 to 4.05 respectively in each of the defined regions averaged and -.21 and 3.44 respectively.

The specific index flood (Q2/drainage area) and the dimensionless frequency ratio (Qt/Q2) varied significantly within each region; this may result from the urbanization of gauged watersheds used or other localized deviations from regional characteristics. This indicates further regionalization may provide a more homogeneous group. It would not be practical or advisable to subdivide the regions further since the hydrometric data coverage would be inadequate in most cases.

The locations of the 12 homogeneous regions are shown in Figure 5.1.1 and their physiographic and climatic characteristics are described in Appendix B. The relationships for each of the regions are shown in Figure 5.2.1 to 5.13.2 and also in Table 5.1.1 The index flood versus drainage area relationships are presented in Tables 5.1.10 to 5.1.21. The range of drainage areas used in establishing these relationships is depicted in Table 5.1.2.

The reliability of the regional relationships was investigated and reveals that the standard error of estimate for the index flood is somewhat high: 0.2 - 0.32, for Regions 1a, 4, 6, 7, 8, 11 and 12 due to considerable data scatter on the regional plots. This is reflected in the relatively high standard error for the index method associated with the 100-year flood flow estimates for Regions 1a, 4, 6, 8, 11 and 12. This is shown in Table 5.1.3.

Eleven stations omitted from the regional analysis were regarded as being ungauged and used to test the regional relationships. The results of this test are shown in Table 5.3.1.

An expected probability adjustment was applied to the dimensionless frequency curves of each region to account for the average number of years of data used in developing the curves for the region. These adjusted curves are shown in Figures 5.1.4 to 5.14.12.

The following are the main conclusions that are drawn from this regional analysis:

1) The data used for each region was generally homogeneous and adequate in quality, extent and range;

2) Flow estimates for watersheds close to regional boundaries could be in considerable error if the regional relationships predict widely different flows. This happens when the hydrologic and climatic characteristics of the drainage basin of interest are more similar to those of the adjoining region.

3) The regional relationships have standard errors of estimate comparable to other similar studies.

4) The station years used in regions 2 and 7 are less than desirable for reliable flow estimates.

5) Several regions with similar relationships possibly could be lumped into one larger region to reduce the standard error and increase the data range; however, in some cases these complimentary regions are in seperate geographical area and combining them could not be justified.

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The Ontario Ministry of the Environment

Ontario Hydro, River Control

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The report and its many drafts were typed primarily by S. Micucci. Assistance provided by the staff of the CCIW computer facility is also acknowledged.

APPENDIX A

APPENDIX A

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REGION 1 HOMOGENEITY TEST -LEGEND TO STATIONS PLOTTED

1=STA:02CA002(R=1.80,13YRS-W)., 2=STA:02CB001(R=1.37,16YRS-W)., 3=STA:02CF007(R=1.38,21YRS-W)., 4=STA:02CF011(R=1.74,12YRS-W)., 5=STA:02D0008(R=1.60,26YRS-W)., 6=STA:02EA003(R=1.49,67YRS-W)., 7=STA:02EA006(R=1.56,67YRS-W)., 8=STA:02EA008(R= .92,12YRS-W)., 9=STA:02EA010(R=1.66,15YRS-W)., 10=STA:02EB006(R=1.22,45YRS-W)., 11=STA:02EB007(R=1.23,23YRS-W)., 12=STA:02HE001(R=1.72,13YRS-W)., 13=STA:02HE002(R=1.53,13YRS-W)., 14=STA:02HL004(R=1.49,18YRS-W)., 15=STA:02HL005(R=1.40,17YRS-W)., 16=STA:02HM004(R=1.52,11YRS-W)., 17=STA:02HM005(R=1.54,10YRS-W)., 18=STA:02KA003(R=1.30,16YRS-W)., 19=STA:02KA004(R=2.20,10YRS-W)., 20=STA:02KA005(R=1.37,16YRS-W)., 21=STA:02KA006(R=1.50,13YRS-W)., 22=STA:02KA007(R=1.80,10YRS-W)., 23=STA:02KC014(R=1.58,14YRS-W)., 24=STA:02KF011(R=1.37,12YRS-W)., 25=STA:02LA006(R=1.26,13YRS-W)., 26=STA:02LA007(R=1.18,14YRS-W)., 27=STA:02CC004(R=1.73,30YRS-R)., 28=STA:02CE002(R=1.60,62YRS-R)., 29=STA:02CP005(R=1.55,24YRS-R)., 30=STA:02CP009(R=1.54,24YRS-R)., 31=STA:02HF003(R=1.40,17YRS-R)., 32=STA:02HM001(R=1.51,22YRS-R)., 33=STA:02HM003(R=1.49,24YRS-R).,

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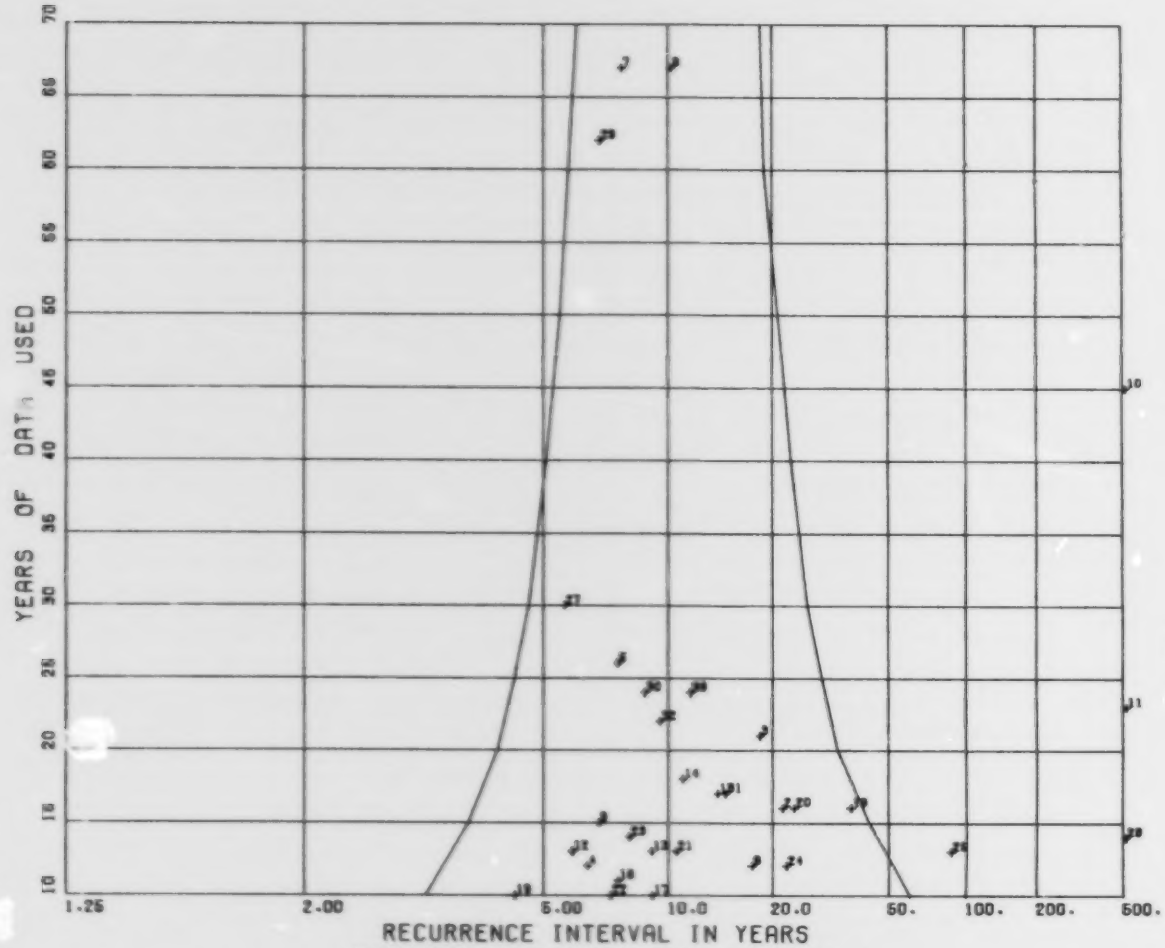

HOMOGENEITY TEST FOR REGION 1

FIGURE A1.1

REGION 2 HOMOGENEITY TEST -LEGEND TO STATIONS PLOTTED

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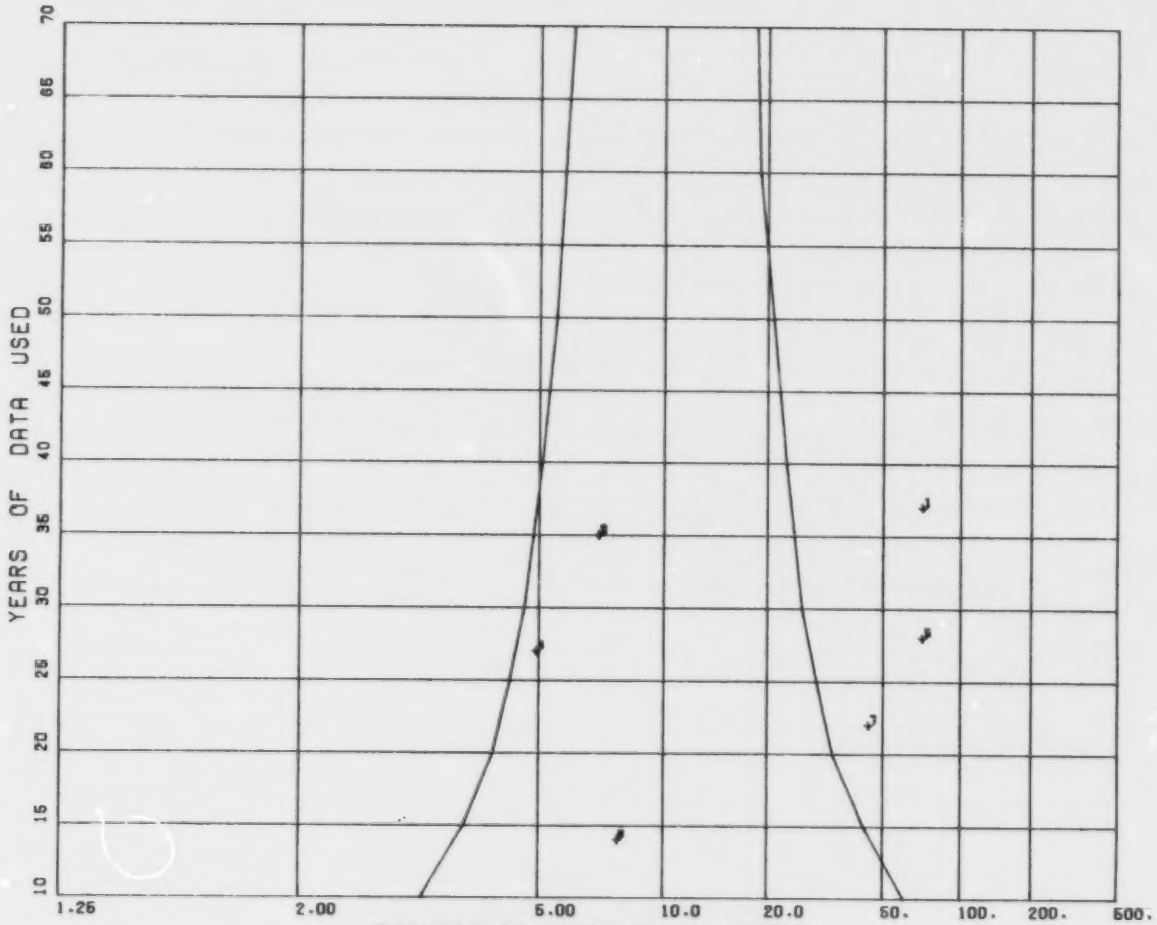

HOMOGENEITY TEST FOR REGION 2
FIGURE A2.1

REGION 3 HOMOGENEITY TEST -LEGEND TO STATIONS PLOTTED

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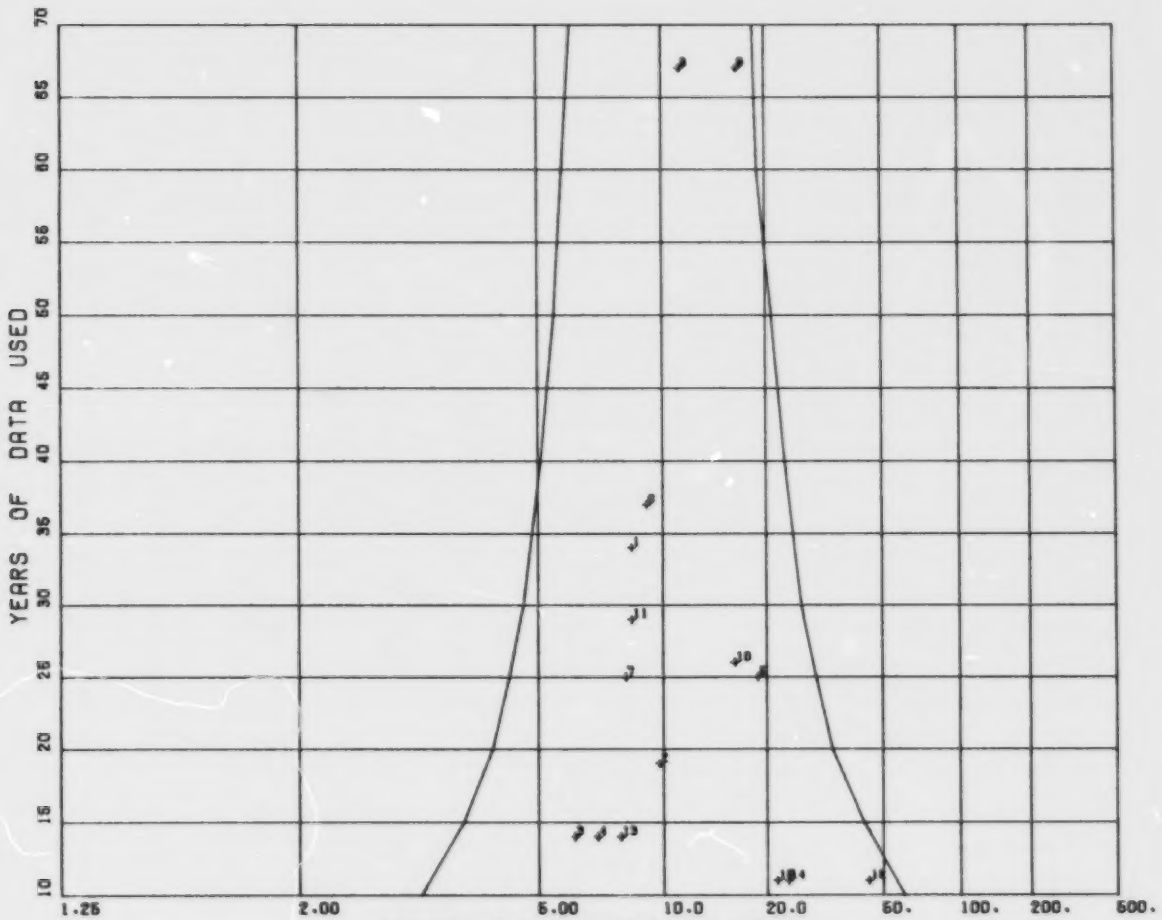


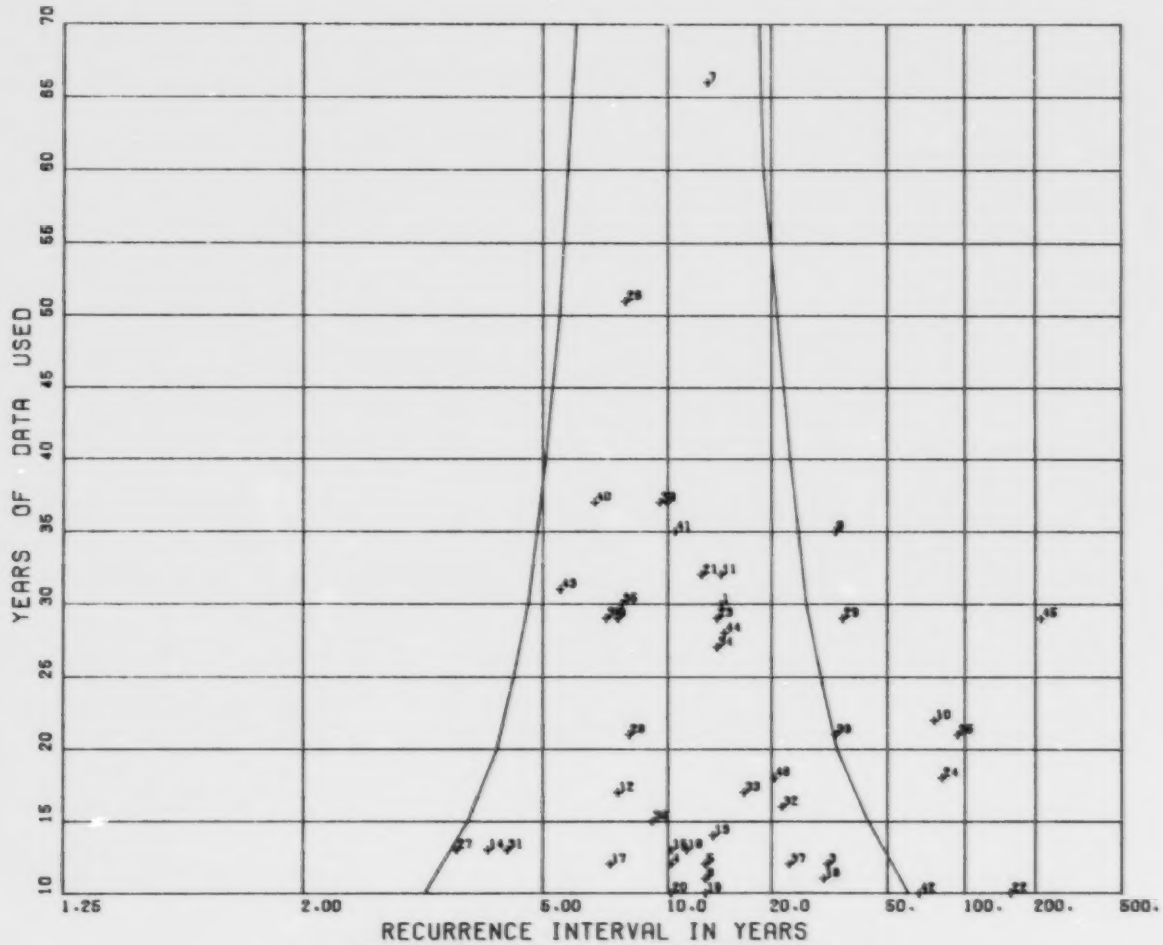
HOMOGENEITY TEST FOR REGION 3

FIGURE A3.1

REGION 4 HOMOGENEITY TEST -LEGEND TO STATIONS PLOTTED

1=STA:02FE002(R=1.69,30YRS-N)., 2=STA:02FE004(R=1.76,37YRS-N)., 3=STA:02FE008(R=1.51,12YRS-N)., 4=STA:02FE009(R=1.79,12YRS-N)., 5=STA:02FE010(R=1.69,12YRS-N)., 6=STA:02GA001(R=1.70,11YRS-N)., 7=STA:02GA003(R=1.70,66YRS-N)., 8=STA:02GA010(R=1.53,35YRS-N)., 9=STA:02GA015(R=1.93,29YRS-N)., 10=STA:02GA017(R=1.45,22YRS-N)., 11=STA:02GA018(R=1.68,32YRS-N)., 12=STA:02GA030(R=1.90,17YRS-N)., 13=STA:02GA031(R=1.60,14YRS-N)., 14=STA:02GA032(R=3.10,13YRS-N)., 15=STA:02GA035(R=1.76,13YRS-N)., 16=STA:02GA036(R=1.75,13YRS-N)., 17=STA:02GA037(R=2.01,12YRS-N)., 18=STA:02GA038(R=1.51,11YRS-N)., 19=STA:02GA039(R=1.68,10YRS-N)., 20=STA:02GA040(R=1.80,10YRS-N)., 21=STA:02GB001(R=1.71,32YRS-N)., 22=STA:02GB002(R=1.32,10YRS-N)., 23=STA:02GB006(R=1.66,29YRS-N)., 24=STA:02GB007(R=1.42,18YRS-N)., 25=STA:02GB008(R=1.43,21YRS-N)., 26=STA:02GB009(R=1.92,21YRS-N)., 27=STA:02GB011(R=3.75,13YRS-N)., 28=STA:02GD001(R=1.96,51YRS-N)., 29=STA:02GD003(R=1.53,29YRS-N)., 30=STA:02GD010(R=1.82,37YRS-N)., 31=STA:02GD012(R=2.73,13YRS-N)., 32=STA:02GD019(R=1.49,16YRS-N)., 33=STA:02GD020(R=1.64,17YRS-N)., 34=STA:02FE003(R=1.69,27YRS-R)., 35=STA:02FE005(R=1.93,30YRS-R)., 36=STA:02FE007(R=1.82,15YRS-R)., 37=STA:02GA022(R=1.54,12YRS-R)., 38=STA:02GA033(R=1.92,29YRS-R)., 39=STA:02GB010(R=1.50,21YRS-R)., 40=STA:02GD004(R=2.02,37YRS-R)., 41=STA:02GD005(R=1.54,35YRS-R)., 42=STA:02GD008(R=1.41,10YRS-R)., 43=STA:02GD011(R=2.17,31YRS-R)., 44=STA:02GD014(R=1.67,28YRS-R)., 45=STA:02GD015(R=1.41,29YRS-R)., 46=STA:02GD018(R=1.54,18YRS-R)..

MEAN RATIO OF Q10/Q2(R)=1.78

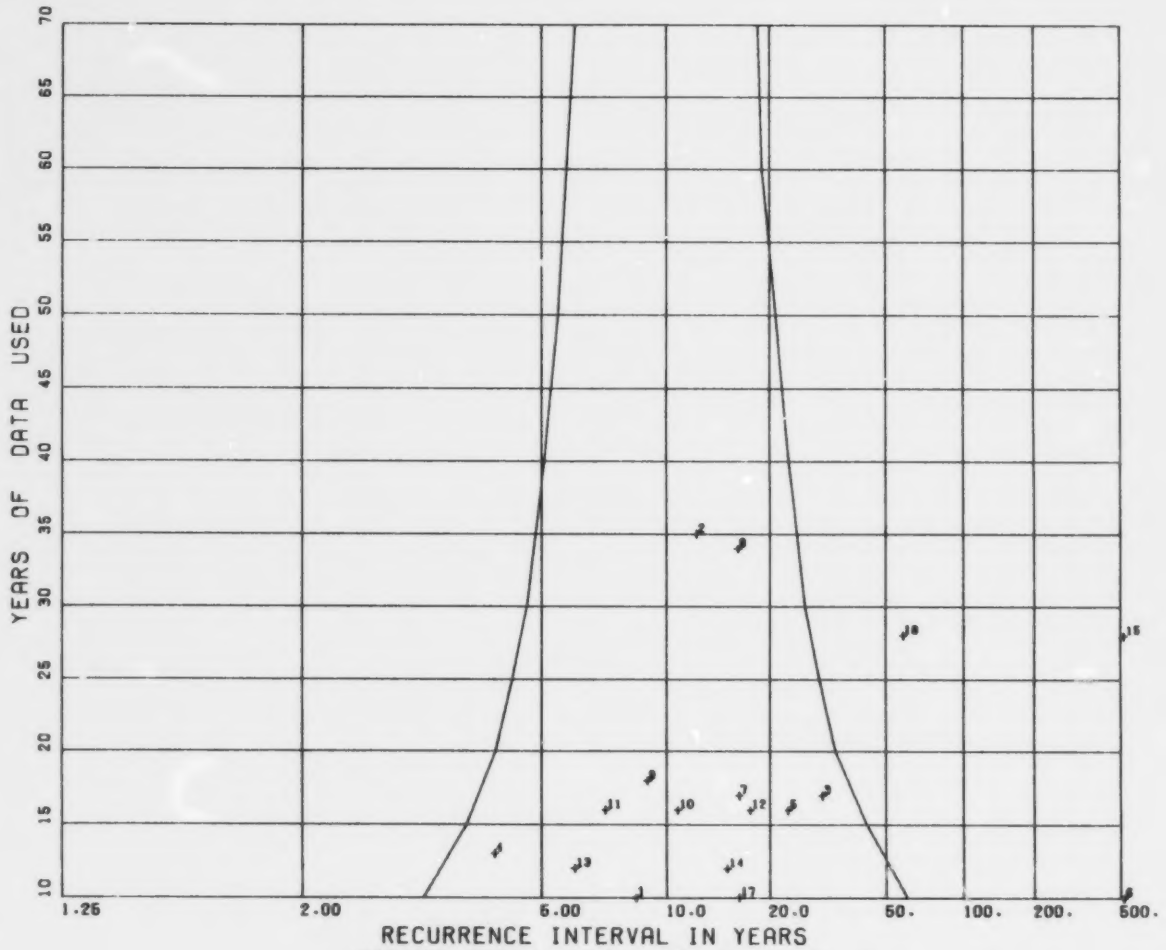


HOMOGENEITY TEST FOR REGION 4
FIGURE A4.1

REGION 5 HOMOGENEITY TEST -LEGEND TO STATIONS PLOTTED

1=STA:02FD001(R=1.82,10YRS-N)., 2=STA:02FF002(R=1.68,35YRS-N)., 3=STA:02FF004(R=1.50,17YRS-N)., 4=STA:02FF006(R=2.70,13YRS-N)., 5=STA:02FF007(R=1.51,16YRS-N)., 6=STA:02FF008(R=1.26,10YRS-N)., 7=STA:02GE005(R=1.60,17YRS-N)., 8=STA:02GG002(R=1.58,34YRS-N)., 9=STA:02GG004(R=1.81,18YRS-N).,10=STA:02GG005(R=1.73,16YRS-N).,11=STA:02GG006(R=1.90,16YRS-N).,12=STA:02GG007(R=1.55,16YRS-N)., 13=STA:02GH001(R=2.07,12YRS-N).,14=STA:02GH002(R=1.62,12YRS-N).,15=STA:02GE002(R=1.35,28YRS-R).,16=STA:02GE003(R=1.44,28YRS-R)., 17=STA:02GE006(R=1.49,10YRS-R).,

MEAN RATIO OF Q10/Q2(R)=1.68

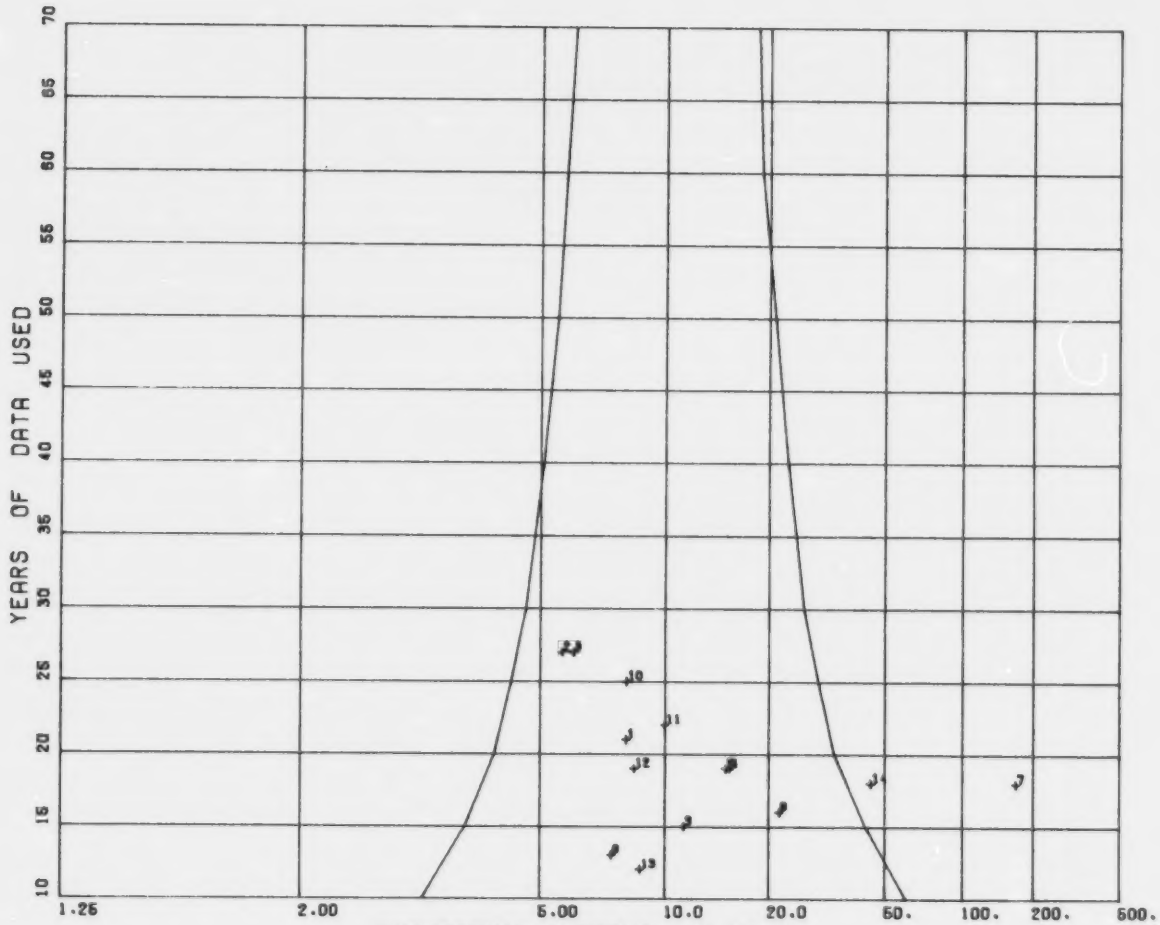


HOMOGENEITY TEST FOR REGION 5
FIGURE A5.1

REGION 6 HOMOGENEITY TEST -LEGEND TO STATIONS PLOTTED

1=STA:02GC004(R=2.03,21YRS-N)., 2=STA:02GC007(R=2.48,27YRS-N)., 3=STA:02GC011(R=1.87,15YRS-N)., 4=STA:02GC012(R=1.80,19YRS-N)., 5=STA:02GC015(R=1.75,19YRS-N)., 6=STA:02GC016(R=2.20,13YRS-N)., 7=STA:02GC018(R=1.43,18YRS-N)., 8=STA:02GC002(R=1.60,16YRS-R)., 9=STA:02GC006(R=2.36,27YRS-R).,10=STA:02GC008(R=2.12,25YRS-R).,11=STA:02GC010(R=1.90,22YRS-R).,12=STA:02GC013(R=2.07,19YRS-R)., 13=STA:02GC014(R=2.00,12YRS-R).,14=STA:02GC017(R=1.55,18YRS-R).,

MEAN RATIO OF Q10/Q2(R)=1.94



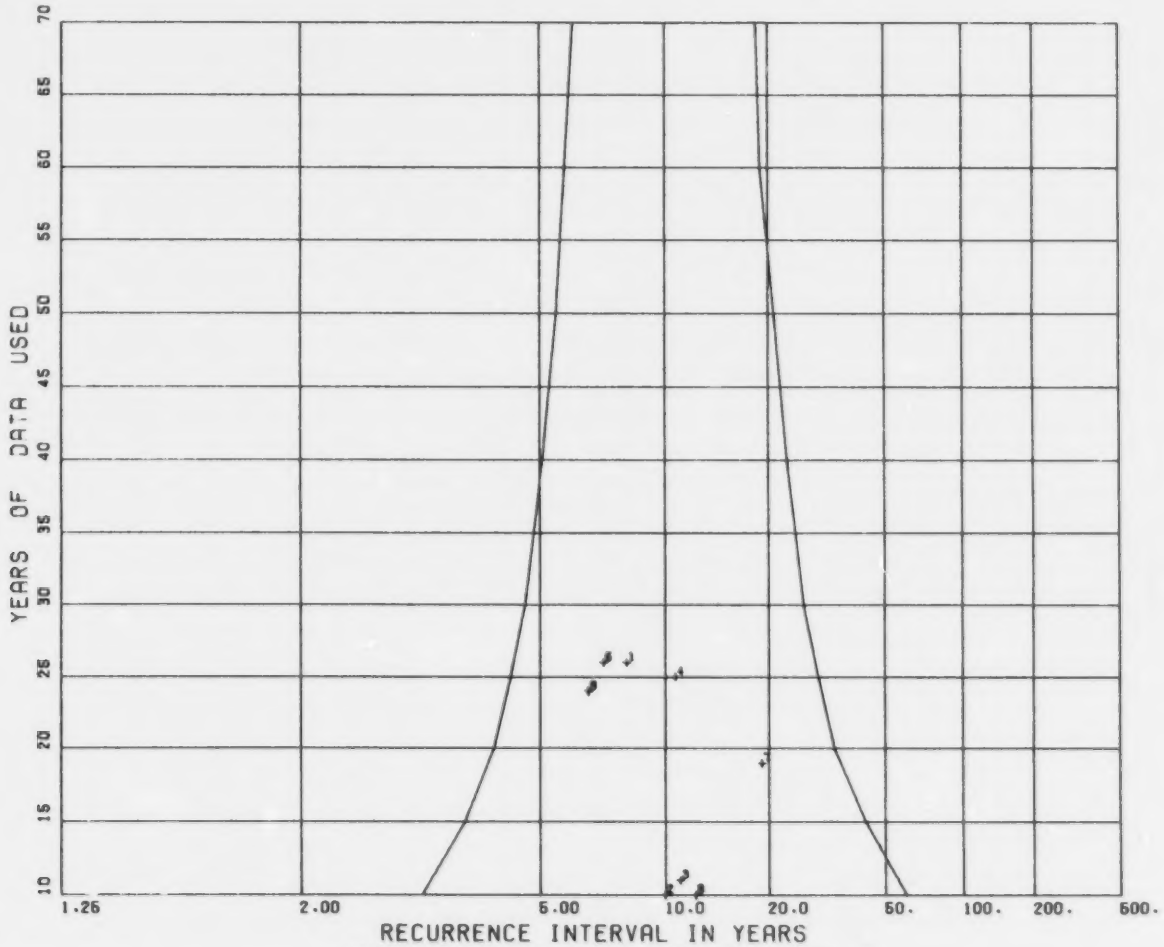
HOMOGENEITY TEST FOR REGION 6

FIGURE A6.1

REGION 7 HOMOGENEITY TEST -LEGEND TO STATIONS PLOTTED

1=STA:02HA006(R=1.59,26YRS-N)., 2=STA:02HB010(R=1.57,10YRS-N)., 3=STA:02HB012(R=1.52,11YRS-N)., 4=STA:02HA007(R=1.54,25YRS-R)., 5=STA:02HB004(R=1.69,26YRS-R)., 6=STA:02HB005(R=1.65,24YRS-R)., 7=STA:02HB011(R=1.39,19YRS-R)., 8=STA:02HB015(R=1.30,10YRS-R).,

MEAN RATIO OF Q10/Q2(R)=1.56



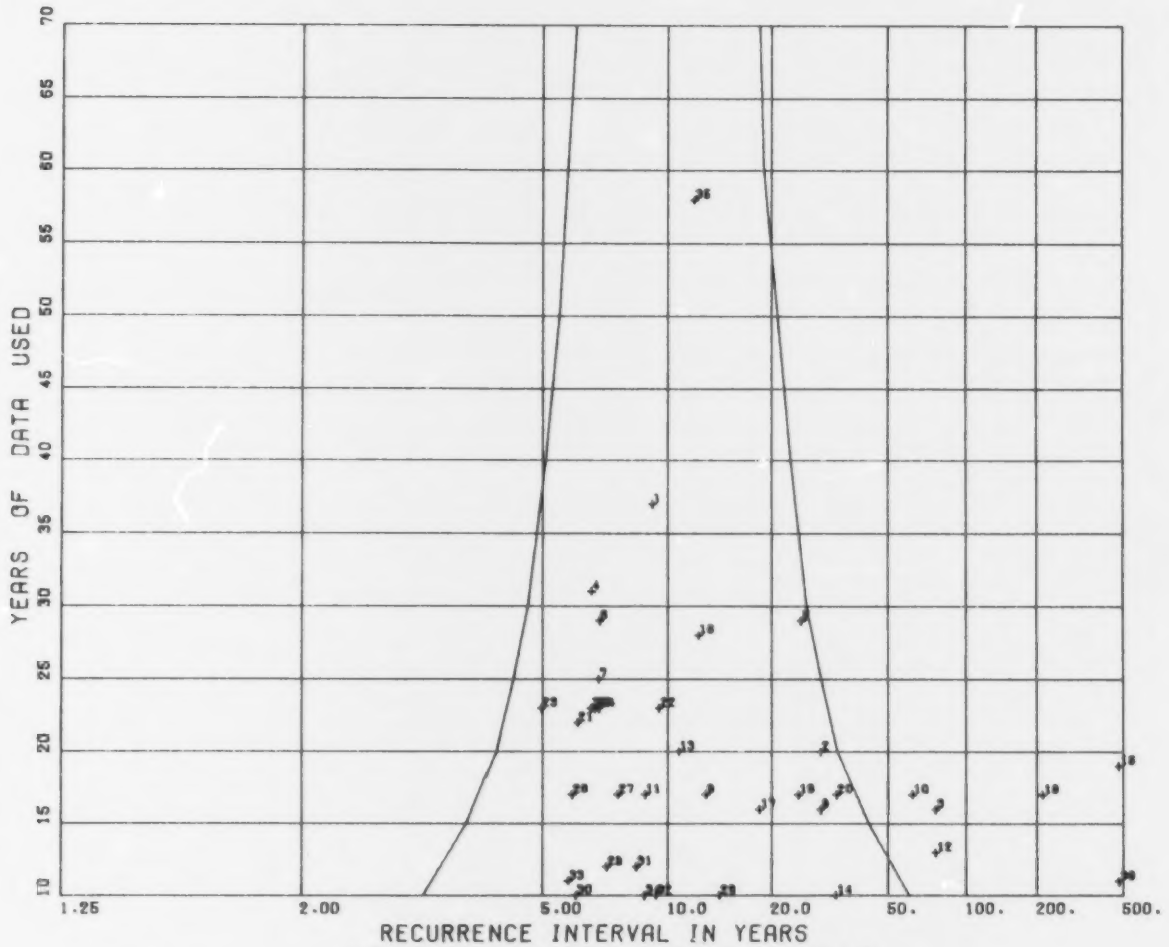
HOMOGENEITY TEST FOR REGION 7

FIGURE A7.1

REGION 8 HOMOGENEITY TEST -LEGEND TO STATIONS PLOTTED

1=STA:02HB002(R=2.11,37YRS-N)., 2=STA:02HB008(R=1.69,20YRS-N)., 3=STA:02HC002(R=1.60,16YRS-N)., 4=STA:02HC003(R=2.34,31YRS-N)., 5=STA:02HC006(R=1.67,29YRS-N)., 6=STA:02HC009(R=2.26,29YRS-N)., 7=STA:02HC012(R=2.35,25YRS-N)., 8=STA:02HC013(R=2.47,17YRS-N)., 9=STA:02HC017(R=1.59,16YRS-N).,10=STA:02HC018(R=1.54,17YRS-N).,11=STA:02HC019(R=2.06,17YRS-N).,12=STA:02HC023(R=1.53,13YRS-N)., 13=STA:02HC025(R=1.97,20YRS-N).,14=STA:02HC027(R=1.55,10YRS-N).,15=STA:02HC028(R=1.39,19YRS-N).,16=STA:02HC029(R=1.90,28YRS-N)., 17=STA:02HC030(R=1.73,16YRS-N).,18=STA:02HC031(R=1.62,17YRS-N).,19=STA:02HC032(R=1.50,17YRS-N).,20=STA:02HC033(R=1.60,17YRS-N)., 21=STA:02HD002(R=2.60,22YRS-N).,22=STA:02HD003(R=2.00,23YRS-N).,23=STA:02HD004(R=2.90,23YRS-N).,24=STA:02HD007(R=2.48,23YRS-N)., 25=STA:02HD008(R=2.32,23YRS-N).,26=STA:02HD009(R=2.50,17YRS-N).,27=STA:02HD010(R=2.19,17YRS-N).,28=STA:02HD211(R=1.86,10YRS-N)., 29=STA:02HD214(R=2.32,12YRS-N).,30=STA:02HD221(R=2.47,10YRS-N).,31=STA:02HD223(R=2.17,12YRS-N).,32=STA:02HD224(R=2.06,10YRS-N)., 33=STA:02HD232(R=2.62,11YRS-N).,34=STA:02HD233(R=2.10,10YRS-N).,35=STA:02NB001(R=1.86,58YRS-R).,36=STA:02HC024(R=1.18,11YRS-R)., 37=STA:02HD006(R=2.35,23YRS-R)..

MEAN RATIO OF Q10/Q2(R)=2.01

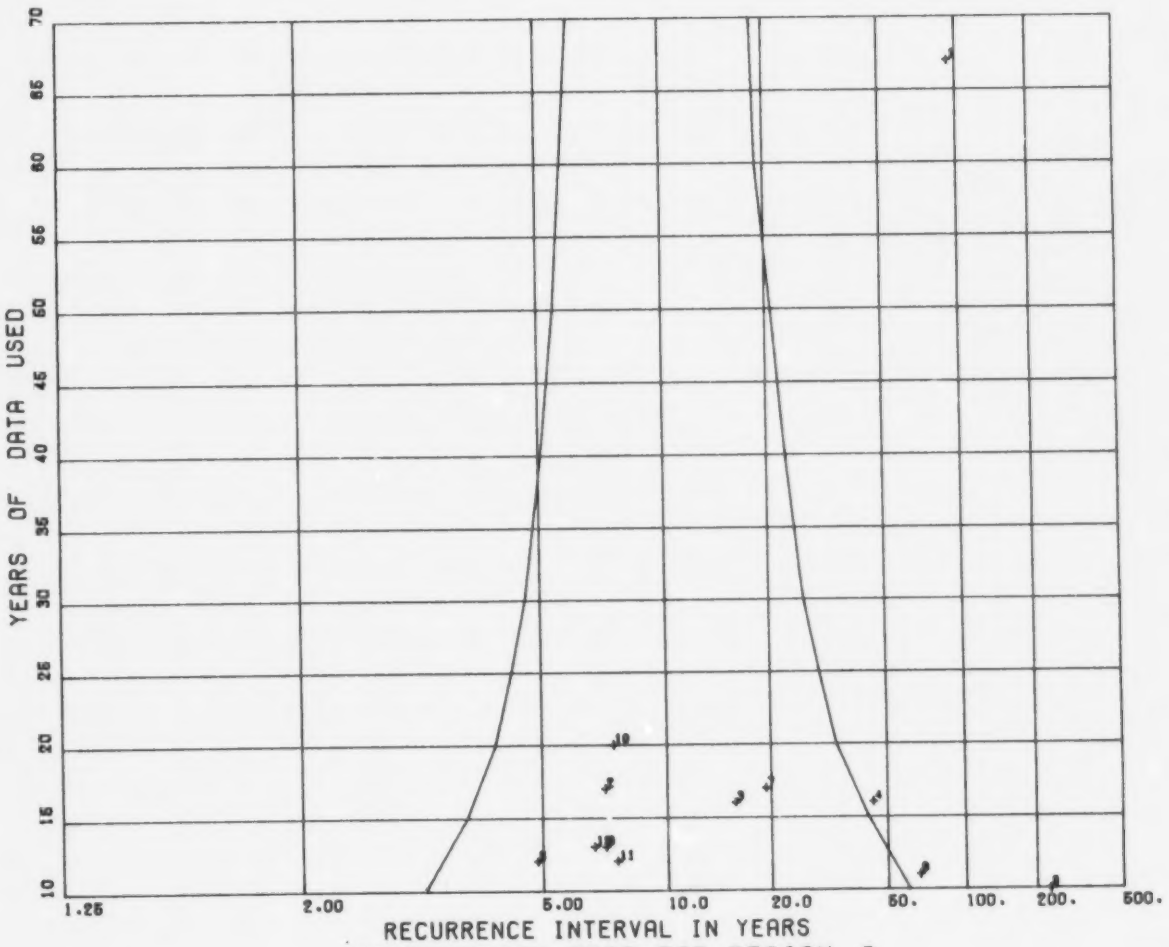


HOMOGENEITY TEST FOR REGION 8
FIGURE A8.1

REGION 9 HOMOGENEITY TEST -LEGEND TO STATIONS PLOTTED

1=STA:02EC002(R=1.32,67YRS-N)., 2=STA:02EC009(R=1.78,17YRS-N)., 3=STA:02EC010(R=1.50,16YRS-N)., 4=STA:02EC011(R=1.33,16YRS-N)., 5=STA:02EC101(R=2.02,12YRS-N)., 6=STA:02EC103(R=1.76,13YRS-N)., 7=STA:02ED007(R=1.44,17YRS-N)., 8=STA:02ED009(R=1.33,11YRS-N)., 9=STA:02ED010(R=1.27,10YRS-N).,10=STA:02HJ001(R=1.79,20YRS-N).,11=STA:02HJ003(R=1.73,12YRS-N).,12=STA:02EC012(R=1.85,13YRS-R)..

MEAN RATIO OF Q10/Q2(R)=1.59

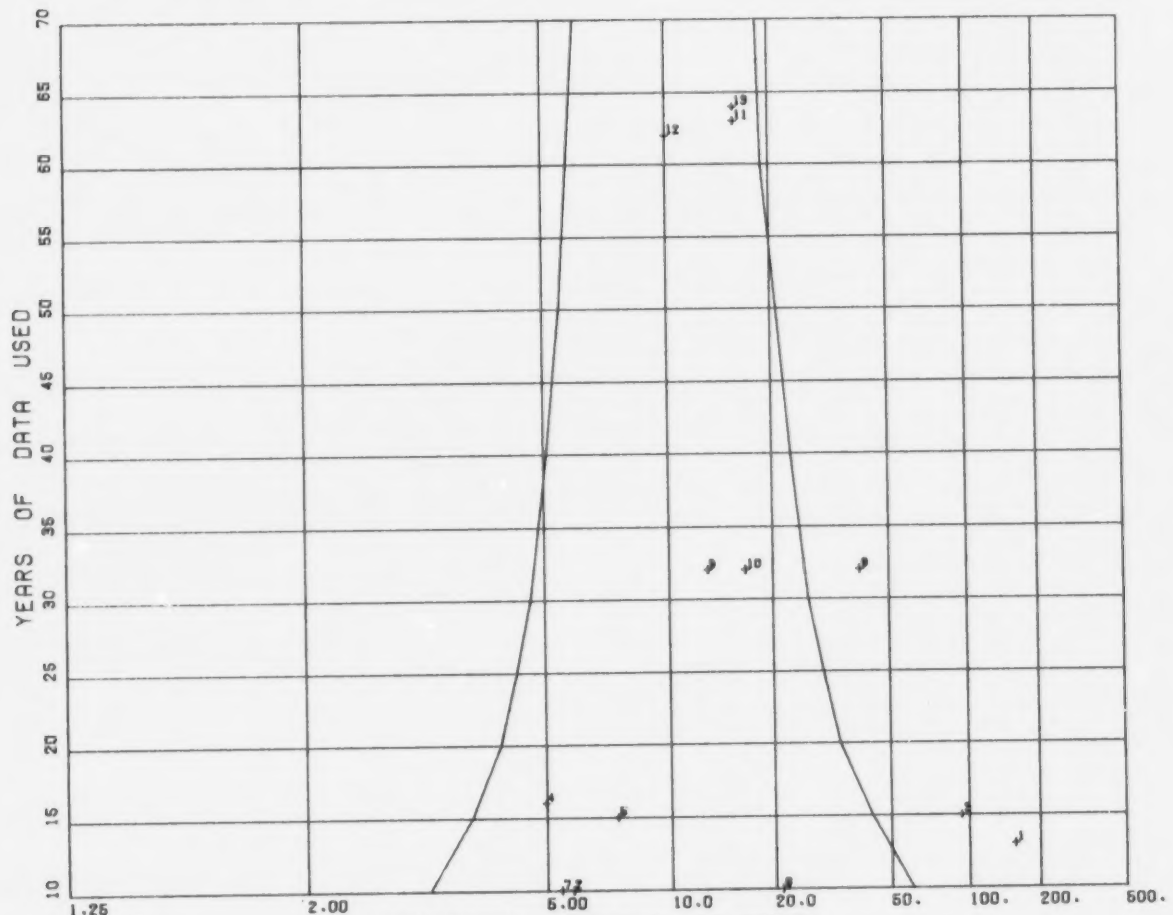


HOMOGENEITY TEST FOR REGION 9
FIGURE A9.1

REGION 10 HOMOGENEITY TEST -LEGEND TO STATIONS PLOTTED

1=STA:02BA002(R=1.28,13YRS-N)., 2=STA:02BA003(R=1.78,10YRS-N)., 3=STA:02BB002(R=1.28,15YRS-N)., 4=STA:02BF001(R=1.95,16YRS-N)., 5=STA:02BF002(R=1.60,15YRS-N)., 6=STA:02JC008(R=1.37,10YRS-N)., 7=STA:02JE018(R=1.83,10YRS-N)., 8=STA:04JA002(R=1.31,32YRS-N)., 9=STA:04JC002(R=1.41,32YRS-N).,10=STA:04JC003(R=1.40,32YRS-N).,11=STA:04LJ001(R=1.42,63YRS-N).,12=STA:04LD001(R=1.47,62YRS-R)., 13=STA:04LF001(R=1.41,64YRS-R)..

MEAN RATIO OF Q10/Q2(R)=1.50



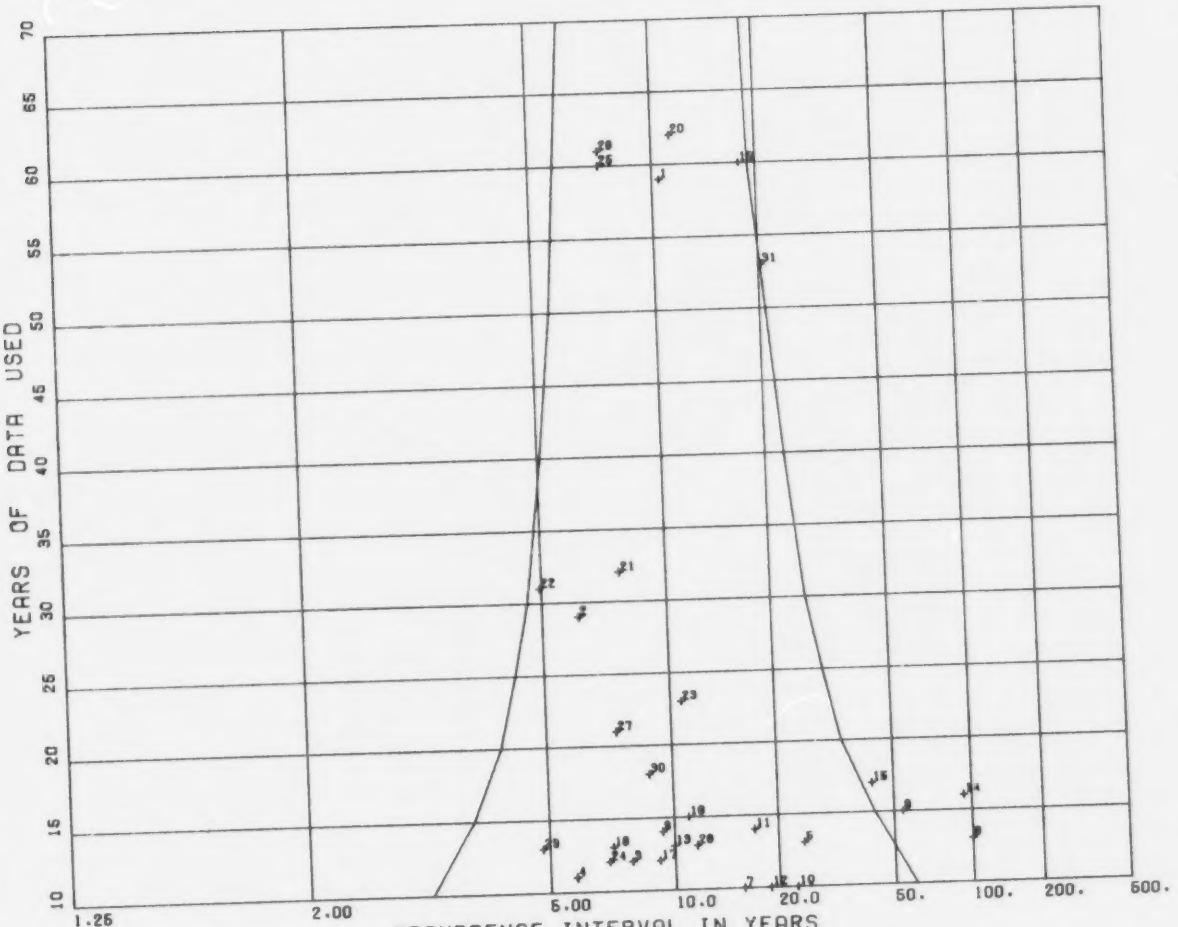
HOMOGENEITY TEST FOR REGION 10

FIGURE A10.1

REGION 11 HOMOGENEITY TEST -LEGEND TO STATIONS PLOTTED

1=STA:02AA001(R=1.66,59YRS-N)., 2=STA:02AB008(R=2.04,29YRS-N)., 3=STA:02AB014(R=1.95,12YRS-N)., 4=STA:02AB016(R=2.17,11YRS-N)., 5=STA:04CA003(R=1.52,13YRS-N)., 6=STA:04CB001(R=1.39,13YRS-N)., 7=STA:04CD002(R=1.61,10YRS-N)., 8=STA:04CE002(R=1.44,15YRS-N)., 9=STA:04DA001(R=1.81,14YRS-N).,10=STA:04DA002(R=1.53,10YRS-N).,11=STA:04DB001(R=1.61,14YRS-N).,12=STA:04DB002(R=1.58,10YRS-N)., 13=STA:04FA001(R=1.77,13YRS-N).,14=STA:04FA003(R=1.38,16YRS-N).,15=STA:04FB001(R=1.45,17YRS-N).,16=STA:04GA002(R=2.07,13YRS-N)., 17=STA:04GB004(R=1.83,12YRS-N).,18=STA:04JF001(R=1.72,15YRS-N).,19=STA:05PA006(R=1.61,60YRS-N).,20=STA:05PB014(R=1.75,62YRS-N)., 21=STA:05PC010(R=1.90,32YRS-N).,22=STA:05PC011(R=2.42,31YRS-N).,23=STA:05PC016(R=1.70,23YRS-N).,24=STA:05PD022(R=2.08,12YRS-N)., 25=STA:05QA001(R=1.84,60YRS-N).,26=STA:05QA002(R=1.93,61YRS-N).,27=STA:05QA004(R=1.96,21YRS-N).,28=STA:05QC003(R=1.70,13YRS-N)., 29=STA:05QE008(R=2.35,13YRS-N).,30=STA:05QE009(R=1.84,18YRS-N).,31=STA:05PA012(R=1.60,53YRS-R)..

MEAN RATIO OF Q10/Q2(R)=1.78

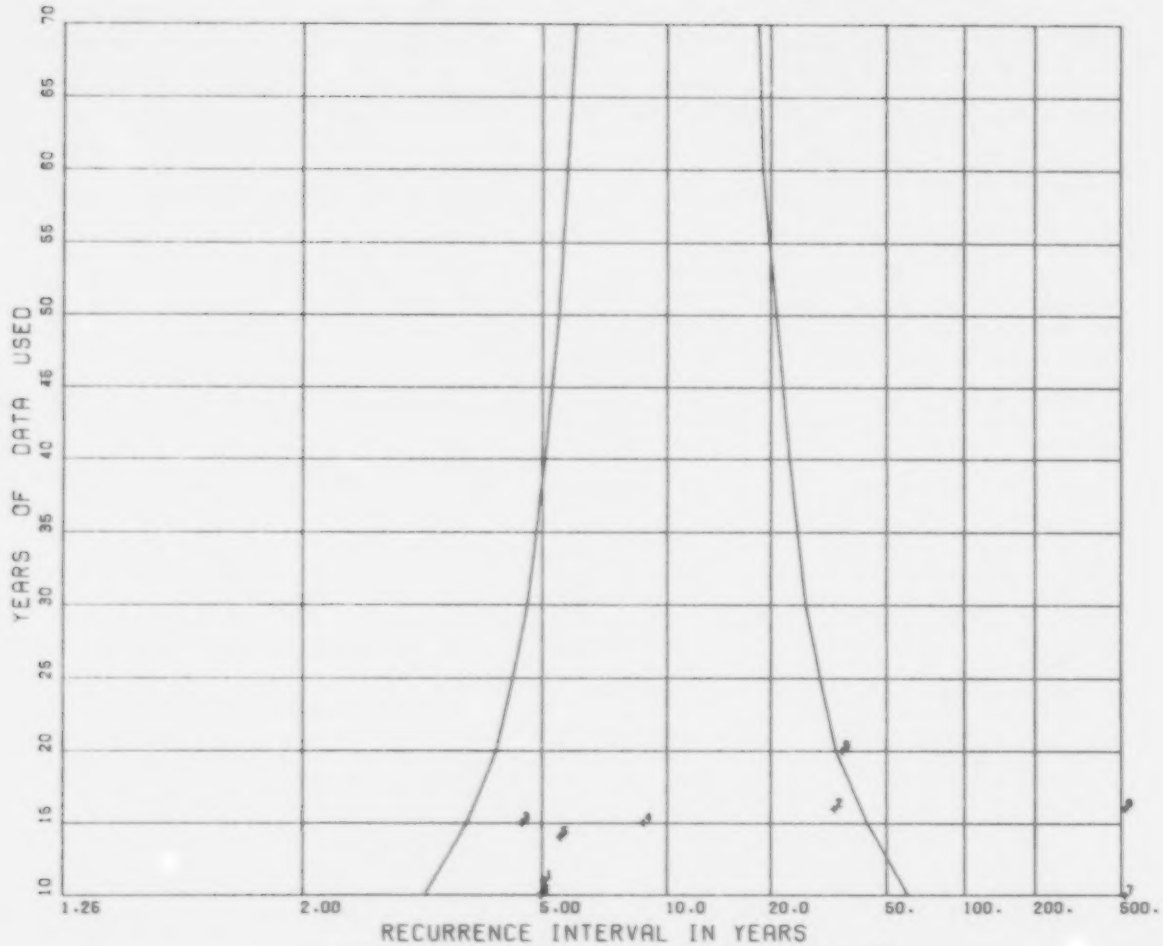


HOMOGENEITY TEST FOR REGION 11
FIGURE A11.1

REGION 12 HOMOGENEITY TEST -LEGEND TO STATIONS PLOTTED

1=STA:04CB001(R=2.02,11YRS-N)., 2=STA:04BC001(R=1.38,16YRS-N)., 3=STA:04BC002(R=1.46,15YRS-N)., 4=STA:04EA001(R=1.64,15YRS-N)., 5=STA:04FC001(R=2.00,14YRS-N)., 6=STA:04KA001(R=1.98,10YRS-N)., 7=STA:04LM001(R=1.22,10YRS-N)., 8=STA:04MF001(R=1.25,16YRS-N)., 9=STA:04LG002(R=1.33,20YRS-R).,

MEAN RATIO OF Q10/Q2(R)=1.59



HOMOGENEITY TEST FOR REGION 12
FIGURE A12.1

STATION PARAMETER STATISTICS FOR REGION 1

---NOTE--- THE FOLLOWING STATISTICS DO NOT INCLUDE DATA WHICH ARE LESS THAN 10 YEARS

TOTAL NUMBER OF STATIONS USED IN CALCULATIONS = 30 NATURAL= 24 REGULATED= 6

RETURN PERIOD	SP. DISCHARGE (NATURAL) MAX	MIN	MED	MEAN	STD	CV	SP. DISCHARGE (REGULATED) MAX	MIN	MED	MEAN	STD	CV	SP. DISCHARGE (TOTAL) MAX	MIN	MED	MEAN	STD	CV
2	.47	.07	.13	.16	.10	.63	.25	.05	.08	.10	.07	.86	.47	.05	.12	.16	.09	.76
5	.61	.09	.18	.23	.13	.71	.33	.07	.11	.14	.09	.86	.61	.07	.18	.21	.13	.72
10	.72	.06	.22	.27	.16	.71	.38	.09	.12	.16	.11	.88	.72	.06	.20	.25	.15	.78
20	.83	.10	.24	.32	.19	.78	.43	.10	.14	.18	.12	.87	.83	.10	.22	.29	.18	.84
50	.97	.11	.26	.38	.24	.91	.48	.13	.16	.21	.14	.86	.97	.11	.24	.34	.23	.97
100	1.09	.12	.27	.43	.29	1.05	.53	.15	.17	.23	.15	.86	1.09	.12	.25	.39	.27	1.08
200	1.22	.13	.29	.48	.34	1.16	.57	.17	.19	.25	.16	.85	1.22	.13	.28	.44	.32	1.16

STATISTICS OF AREAS

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
1850.0	.2	152.0	333.0	404.1	1.33	9270.0	89.1	1080.5	2274.5	3456.4	1.5	9270.0	.2	270.5	697.3	1683.8	2.4

STATISTICS OF SKEWNESS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
.82	-.64	-.09	-.13	.31	-2.44	.07	-.17	-.10	-.06	.10	-1.57	.82	-.64	-.09	-.11	.28	-2.45

STATISTICS OF KURTOSIS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
5.82	2.54	3.52	3.81	1.06	.28	4.32	2.44	3.17	3.27	.79	.24	5.82	2.44	3.52	3.70	1.82	.28

STATISTICS OF SP. MEAN (ARITHMETIC) / MEAN ANNUAL RUN OFF (PM.)/ BASE FLOW INDEX

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
.50	.07	.15	.19	.10	.55	.27	.06	.04	.11	.08	.69	.50	.06	.14	.17	.10	.59
625.50	187.50	410.17	415.19	114.15	.27	506.17	365.88	405.75	419.60	57.13	.14	625.50	187.50	410.17	416.11	104.41	.25
.76	.27	.45	.48	.14	.28	.84	.37	.72	.68	.17	.25	.84	.27	.50	.52	.16	.31

TABLE # A1.1

STATION PARAMETER STATISTICS FOR REGION 2

---NOTE--- THE FOLLOWING STATISTICS DO NOT INCLUDE DATA WHICH ARE LESS THAN 10 YEARS

TOTAL NUMBER OF STATIONS USED IN CALCULATIONS = 7 NATURAL= 7 REGULATED= 0

RETURN PERIOD	SP. DISCHARGE (NATURAL) MAX	MIN	MED	MEAN	STD	CV	SP. DISCHARGE (REGULATED) MAX	MIN	MED	MEAN	STD	CV	SP. DISCHARGE (TOTAL) MAX	MIN	MED	MEAN	STD	CV
2	.33	.19	.23	.25	.05	.22							.33	.19	.23	.25	.05	.22
5	.45	.24	.29	.33	.08	.28							.45	.24	.29	.33	.08	.28
10	.54	.26	.35	.39	.11	.33							.54	.26	.35	.39	.11	.33
20	.62	.28	.40	.45	.15	.39							.62	.28	.40	.45	.15	.39
50	.81	.30	.46	.53	.22	.48							.81	.30	.46	.53	.22	.48
100	1.02	.31	.50	.60	.28	.56							1.02	.31	.50	.60	.28	.56
200	1.26	.32	.55	.67	.36	.66							1.26	.32	.55	.67	.36	.66

STATISTICS OF AREAS

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
3810.0	76.7	433.0	922.8	1308.2	1.42							3819.0	76.7	433.0	922.8	1308.2	1.4

STATISTICS OF SKEWNESS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
-.01	-.38	-.02	-.08	.13	-1.61							-.01	-.38	-.02	-.08	.13	-1.61

STATISTICS OF KURTOSIS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
3.81	2.46	3.27	3.21	.45	.14							3.81	2.46	3.27	3.21	.45	.14

STATISTICS OF SP. MEAN (ARITHMETIC) / MEAN ANNUAL RUN OFF (MM.)/ BASE FLOW INDEX

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
.36 498 .10 .39	349 .19 .26	420 .23 .30	425 .26 .31	51 .06 .05	.25 .15 .15							.36 498 .10 .39	349 .19 .26	420 .23 .30	425 .26 .31	51 .06 .05	.25 .15 .15

TABLE : A2.1

STATION PARAMETER STATISTICS FOR REGION 3

---NOTE--- THE FOLLOWING STATISTICS DO NOT INCLUDE DATA WHICH ARE LESS THAN 10 YEARS

TOTAL NUMBER OF STATIONS USED IN CALCULATIONS : 15 NATURAL: 12 REGULATED: 3

RETURN PERIOD	SP. DISCHARGE (NATURAL) MAX	MIN	MED	MEAN	STD	CV	SP. DISCHARGE (REGULATED) MAX	MIN	MED	MEAN	STD	CV	SP. DISCHARGE (TOTAL) MAX	MIN	MED	MEAN	STD	CV
2	.22	.07	.15	.15	.05	.32	.27	.14	.14	.18	.07	.51	.27	.07	.14	.16	.05	.36
5	.33	.10	.20	.22	.07	.38	.34	.18	.21	.25	.09	.41	.34	.10	.20	.23	.07	.37
10	.42	.11	.23	.27	.10	.42	.40	.21	.26	.29	.10	.38	.42	.11	.24	.27	.09	.39
20	.50	.12	.26	.32	.12	.44	.46	.24	.31	.34	.10	.33	.50	.12	.26	.31	.10	.41
50	.66	.15	.35	.39	.16	.46	.52	.28	.40	.41	.12	.30	.66	.15	.36	.39	.15	.41
100	.78	.17	.41	.44	.19	.47	.57	.31	.47	.46	.13	.28	.78	.17	.43	.46	.18	.41
200	.92	.18	.47	.50	.23	.49	.62	.35	.55	.50	.14	.26	.92	.18	.51	.50	.21	.41

STATISTICS OF AREAS

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
3960.0	163.0	294.0	872.3	1137.9	1.30	635.00	86.00	262.00	327.67	280.33	.86	3960.0	86.0	293.0	763.3	1038.9	1.3

STATISTICS OF SKEWNESS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
.63	-.59	-.00	-.01	.29	-26.77	-.03	-.20	-.17	-.14	.09	-.67	.63	-.59	-.01	-.04	.27	-7.45

STATISTICS OF KURTOSIS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
6.31	2.39	3.25	3.48	1.01	.29	4.82	2.98	3.27	3.63	.99	.27	6.31	2.39	3.27	3.53	.97	.28

STATISTICS OF SP. MEAN (ARITHMETIC) / MEAN ANNUAL RUN OFF (MM.)/ BASE FLOW INDEX

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
.26	.08	.16	.17	.06	.32	.28	.15	.16	.20	.07	.36	.28	.08	.16	.18	.06	.32
512.82	255.08	444.52	422.17	77.19	.18	549.62	209.30	464.57	407.63	177.11	.43	549.62	209.30	445.78	419.30	95.91	.23
.81	.51	.61	.61	.08	.14	.67	.42	.57	.55	.13	.24	.81	.42	.61	.60	.09	.15

TABLE : A3.1

STATION PARAMETER STATISTICS FOR REGION 4

---NOTE--- THE FOLLOWING STATISTICS DO NOT INCLUDE DATA WHICH ARE LESS THAN 10 YEARS

TOTAL NUMBER OF STATIONS USED IN CALCULATIONS : 47 NATURAL: 34 REGULATED: 13

RETURN PERIOD	SP. DISCHARGE (NATURAL) MAX	MIN	MED	MEAN	STD	CV	SP. DISCHARGE (REGULATED) MAX	MIN	MED	MEAN	STD	CV	SP. DISCHARGE (TOTAL) MAX	MIN	MED	MEAN	STD	CV
2	.88	.11	.26	.34	.21	.79	.68	.13	.31	.35	.14	.45	.88	.11	.28	.34	.19	.68
5	1.85	.16	.37	.50	.35	.95	.95	.17	.49	.49	.19	.39	1.85	.16	.42	.50	.31	.75
10	2.72	.18	.48	.62	.49	1.02	1.13	.19	.58	.58	.22	.38	2.72	.18	.54	.61	.43	.80
20	3.75	.20	.57	.74	.65	1.13	1.31	.22	.67	.67	.26	.38	3.75	.20	.65	.72	.57	.87
50	5.37	.22	.69	.92	.91	1.33	1.54	.24	.81	.79	.30	.38	5.37	.22	.76	.88	.79	1.04
100	6.82	.24	.77	1.06	1.15	1.50	1.72	.26	.89	.87	.35	.39	6.82	.24	.85	1.01	.99	1.17
200	8.50	.25	.85	1.22	1.43	1.69	1.88	.27	.98	.96	.39	.40	8.50	.25	.89	1.15	1.23	1.39

STATISTICS OF AREAS

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
5910.0	2.5	325.0	841.0	1396.2	1.66	1340.0	64.8	306.0	408.1	399.6	1.0	5910.0	2.5	319.0	721.3	1215.9	1.6

STATISTICS OF SKEWNESS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
.11	-.57	-.38	-.11	.13	-1.24	.10	-.16	-.01	-.03	.06	-2.23	.11	-.57	-.06	-.08	.12	-1.43

STATISTICS OF KURTOSIS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
9.45	2.21	3.18	3.41	1.19	.35	5.32	2.49	3.34	3.43	.82	.24	9.45	2.21	3.20	3.43	1.09	.32

STATISTICS OF SP. MEAN (ARITHMETIC) / MEAN ANNUAL RUN OFF (MM.)/ BASE FLOW INDEX

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
1.20	.11	.29	.37	.25	.66	.75	.13	.35	.38	.15	.40	1.20	.11	.31	.37	.22	.59
484.04	136.42	350.77	359.85	65.89	.18	463.19	299.24	385.82	377.61	51.49	.14	484.04	136.42	354.12	364.77	62.21	.17
.73	.19	.39	.40	.14	.34	.46	.26	.36	.36	.06	.18	.73	.19	.36	.38	.12	.31

TABLE : A4.1

STATION PARAMETER STATISTICS FOR REGION 5

---NOTE--- THE FOLLOWING STATISTICS DO NOT INCLUDE DATA WHICH ARE LESS THAN 10 YEARS

TOTAL NUMBER OF STATIONS USED IN CALCULATIONS : 17 NATURAL: 14 REGULATED: 3

RETURN PERIOD	SP. DISCHARGE (NATURAL) MAX	MIN	MED	MEAN	STD	CV	SP. DISCHARGE (REGULATED) MAX	MIN	MED	MEAN	STD	CV	SP. DISCHARGE (TOTAL) MAX	MIN	MED	MEAN	STD	CV
2	1.06	.12	.30	.36	.25	.81	.21	.13	.14	.16	.05	.34	1.06	.12	.24	.32	.24	.99
5	1.69	.15	.43	.52	.39	.92	.27	.16	.17	.20	.06	.34	1.69	.15	.34	.47	.38	1.12
10	2.18	.18	.48	.64	.51	1.06	.29	.18	.21	.23	.06	.27	2.18	.18	.39	.57	.49	1.25
20	2.75	.21	.55	.76	.65	1.17	.31	.20	.26	.25	.05	.21	2.75	.20	.44	.67	.61	1.40
50	3.59	.25	.64	.93	.85	1.34	.35	.22	.33	.30	.07	.21	3.59	.22	.51	.82	.81	1.59
100	4.30	.29	.70	1.06	1.02	1.46	.44	.23	.34	.34	.11	.31	4.30	.23	.59	.93	.97	1.63
200	5.00	.33	.78	1.20	1.20	1.55	.56	.24	.35	.38	.16	.46	5.00	.24	.67	1.05	1.13	1.68

STATISTICS OF AREAS

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
1240.0	14.2	163.0	355.2	377.3	1.05	4300.0	3110.0	3760.0	3723.3	595.8	.2	4300.0	14.2	267.0	949.6	1381.9	1.4

STATISTICS OF SKEWNESS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
.23	-.25	-.04	-.03	.14	-5.50	-.01	-.36	-.06	-.14	.19	-1.34	.23	-.36	-.04	-.05	.15	-3.30

STATISTICS OF KURTOSIS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
6.71	2.87	3.82	4.04	1.12	.28	4.56	2.86	3.16	3.53	.91	.26	6.71	2.86	3.81	3.95	1.07	.27

STATISTICS OF SP. MEAN (ARITHMETIC) / MEAN ANNUAL RUN OFF (MM.)/ BASE FLOW INDEX

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
1.34	.13	.33	.41	.31	.76	.21	.13	.15	.15	.04	.26	1.34	.13	.26	.36	.30	.81
431.82	295.40	357.10	352.46	50.59	.14	436.17	367.44	376.21	393.27	37.41	.10	436.17	286.40	364.73	359.66	50.12	.14
.47	.15	.28	.29	.10	.36	.51	.45	.49	.49	.03	.06	.51	.15	.33	.32	.12	.37

TABLE : A5.1

STATION PARAMETER STATISTICS FOR REGION 6

---NOTE--- THE FOLLOWING STATISTICS DO NOT INCLUDE DATA WHICH ARE LESS THAN 10 YEARS

TOTAL NUMBER OF STATIONS USED IN CALCULATIONS : 14 NATURAL: 7 REGULATED: 7

RETURN PERIOD	SP. DISCHARGE (NATURAL) MAX	MIN	MED	MEAN	STD	CV	SP. DISCHARGE (REGULATED) MAX	MIN	MED	MEAN	STD	CV	SP. DISCHARGE (TOTAL) MAX	MIN	MED	MEAN	STD	CV
2	.39	.07	.12	.16	.11	.98	.41	.09	.18	.19	.11	.63	.41	.07	.13	.17	.11	.82
5	.50	.12	.16	.23	.14	.84	.55	.15	.27	.28	.14	.52	.55	.12	.22	.26	.13	.61
10	.56	.17	.22	.29	.15	.74	.66	.18	.33	.34	.16	.47	.66	.17	.29	.31	.15	.52
20	.63	.19	.23	.34	.16	.71	.76	.23	.40	.41	.17	.44	.76	.19	.36	.37	.17	.47
50	.70	.25	.30	.41	.18	.59	.90	.29	.46	.49	.20	.43	.90	.25	.44	.45	.19	.42
100	.76	.27	.37	.47	.19	.52	1.01	.35	.50	.56	.22	.43	1.01	.27	.49	.52	.20	.41
200	.81	.31	.45	.54	.21	.46	1.13	.40	.56	.63	.24	.42	1.13	.31	.55	.59	.22	.40

STATISTICS OF AREAS

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
697.00	51.30	142.00	293.04	258.89	.91	363.00	65.80	134.00	200.41	136.96	.68	697.00	51.30	138.00	241.73	203.55	.84

STATISTICS OF SKEWNESS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
.21	-1.00	-.13	-.18	.39	-2.20	.58	-.21	-.07	0.00	.26	R	.58	-1.00	-.09	-.09	.34	-3.75

STATISTICS OF KURTOSIS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
4.65	2.96	3.64	3.75	.69	.18	3.49	2.43	3.17	3.16	.37	.12	4.65	2.43	3.34	3.45	.61	.18

STATISTICS OF SP. MEAN (ARITHMETIC) / MEAN ANNUAL RUN OFF (MM.)/ BASE FLOW INDEX

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
.41 438.46 .80	.09 330.99 .28	.13 393.73 .60	.18 382.16 .60	.11 43.52 .17	.65 .11 .29	.44 400.53 .77	.11 327.42 .26	.20 370.82 .52	.21 369.15 .56	.11 23.69 .18	.55 .06 .32	.44 438.46 .80	.09 327.82 .26	.16 372.35 .60	.19 375.66 .58	.11 34.33 .17	.58 .09 .29

TABLE : A6.1

STATION PARAMETER STATISTICS FOR REGION 7

---NOTE--- THE FOLLOWING STATISTICS DO NOT INCLUDE DATA WHICH ARE LESS THAN 10 YEARS

TOTAL NUMBER OF STATIONS USED IN CALCULATIONS : 8 NATURAL: 3 REGULATED: 5

RETURN PERIOD	SP. DISCHARGE (NATURAL) MAX	MIN	MED	MEAN	STD	CV	SP. DISCHARGE (REGULATED) MAX	MIN	MED	MEAN	STD	CV	SP. DISCHARGE (TOTAL) MAX	MIN	MED	MEAN	STD	CV
2	.30	.13	.25	.23	.09	.36	.30	.09	.18	.18	.08	.47	.30	.09	.19	.19	.08	.44
5	.41	.17	.34	.31	.12	.36	.42	.12	.24	.24	.12	.51	.42	.12	.26	.26	.12	.46
10	.46	.20	.40	.35	.14	.34	.50	.14	.29	.28	.15	.52	.50	.14	.31	.31	.14	.46
20	.51	.23	.45	.39	.15	.33	.58	.15	.33	.32	.18	.53	.58	.15	.35	.35	.16	.46
50	.57	.26	.51	.44	.16	.32	.68	.17	.40	.37	.21	.53	.68	.17	.41	.40	.19	.46
100	.61	.28	.55	.48	.17	.31	.76	.18	.45	.41	.24	.53	.76	.18	.46	.43	.21	.45
200	.65	.30	.59	.52	.19	.32	.83	.19	.50	.45	.26	.53	.83	.19	.50	.47	.23	.45

STATISTICS OF AREAS

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
293.00	82.60	166.00	180.53	105.95	.59	235.00	63.50	199.00	164.62	79.69	.48	293.00	63.50	182.50	170.59	83.09	.49

STATISTICS OF SKEWNESS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
-.02	-.10	-.03	-.05	.04	-.98	.07	-.51	.01	-.08	.24	-2.37	.07	-.51	-.02	-.07	.18	-2.72

STATISTICS OF KURTOSIS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
4.52	3.28	3.28	3.69	.71	.19	5.39	2.98	4.26	4.18	.88	.21	5.39	2.98	4.05	3.99	.81	.20

STATISTICS OF SP. MEAN (ARITHMETIC) / MEAN ANNUAL RUN OFF (MM.)/ BASE FLOW INDEX

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
.31	.13	.26	.24	.09	.40	.32	.09	.19	.18	.09	.50	.32	.09	.21	.20	.09	.44
348.67	301.71	345.24	331.87	26.18	.09	394.35	244.72	348.03	329.94	58.29	.18	394.35	244.72	346.64	330.66	46.24	.14
.52	.15	.45	.37	.19	.52	.64	.18	.53	.45	.21	.48	.64	.15	.48	.42	.20	.47

TABLE : A7.1

STATION PARAMETER STATISTICS FOR REGION 8

---NOTE--- THE FOLLOWING STATISTICS DO NOT INCLUDE DATA WHICH ARE LESS THAN 10 YEARS

TOTAL NUMBER OF STATIONS USED IN CALCULATIONS : 37 NATURAL: 34 REGULATED: 3

RETURN PERIOD	SP. DISCHARGE (NATURAL) MAX	MIN	MED	MEAN	STD	CV	SP. DISCHARGE (REGULATED) MAX	MIN	MED	MEAN	STD	CV	SP. DISCHARGE (TOTAL) MAX	MIN	MED	MEAN	STD	CV
2	.88	.11	.30	.33	.20	.65	.45	.11	.31	.29	.17	.54	.88	.11	.31	.32	.19	.64
5	1.32	.17	.45	.51	.28	.62	.54	.16	.50	.40	.21	.42	1.32	.16	.46	.50	.28	.60
10	1.78	.21	.56	.65	.35	.64	.74	.20	.53	.49	.27	.51	1.78	.20	.55	.63	.35	.64
25	2.38	.24	.71	.80	.45	.63	.98	.23	.54	.58	.37	.69	2.38	.23	.70	.78	.44	.64
50	3.42	.26	.94	1.02	.62	.66	1.34	.28	.56	.73	.55	.98	3.42	.26	.90	.99	.61	.68
100	4.42	.28	1.10	1.21	.79	.71	1.66	.32	.57	.85	.72	1.26	4.42	.28	1.08	1.16	.78	.72
200	5.65	.30	1.26	1.42	.99	.79	2.04	.37	.57	.99	.91	1.59	5.65	.30	1.25	1.39	.98	.79

STATISTICS OF AREAS

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
800.00	4.90	85.35	141.31	182.58	1.29	316.00	82.30	205.00	201.30	116.59	.58	800.00	4.90	88.10	146.17	177.73	1.22

STATISTICS OF SKEWNESS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
1.32	-.37	-.05	-.00	.31	-87.30	.09	-.06	.03	.02	.07	3.51	1.32	-.37	-.05	-.00	.30	******

STATISTICS OF KURTOSIS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
9.16	2.25	3.68	4.20	1.48	.35	5.62	3.51	4.35	4.49	1.06	.24	9.16	2.25	3.70	4.22	1.44	.34

STATISTICS OF SP. MEAN (ARITHMETIC) / MEAN ANNUAL RUN OFF (MM.)/ BASE FLOW INDEX

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
1.10	.13	.33	.38	.22	.58	.44	.12	.41	.32	.17	.54	1.10	.12	.33	.38	.22	.57
527.49	135.48	309.30	308.34	92.10	.30	482.51	271.22	379.75	377.83	105.66	.28	527.49	135.48	314.03	313.97	93.62	.30
.70	.19	.55	.49	.14	.29	.65	.49	.53	.58	.08	.14	.70	.19	.55	.50	.13	.27

TABLE : A8.1

STATION PARAMETER STATISTICS FOR REGION 9

---NOTE--- THE FOLLOWING STATISTICS DO NOT INCLUDE DATA WHICH ARE LESS THAN 10 YEARS

TOTAL NUMBER OF STATIONS USED IN CALCULATIONS : 12 NATURAL: 11 REGULATED: 1

RETURN PERIOD	SP. DISCHARGE (NATURAL) MAX	MIN	MED	MEAN	STD	CV	SP. DISCHARGE (REGULATED) MAX	MIN	MED	MEAN	STD	CV	SP. DISCHARGE (TOTAL) MAX	MIN	MED	MEAN	STD	CV
2	.28	.09	.17	.17	.06	.33	.10	.10	.10	.10	0.00	0.00	.28	.09	.16	.16	.06	.36
5	.35	.10	.23	.22	.07	.30	.15	.15	.15	.15	0.00	0.00	.35	.10	.22	.22	.07	.32
10	.38	.11	.26	.26	.08	.31	.19	.19	.19	.19	0.00	0.00	.38	.11	.26	.25	.08	.31
20	.41	.12	.29	.29	.09	.31	.24	.24	.24	.24	0.00	0.00	.41	.12	.29	.29	.09	.31
50	.47	.13	.35	.34	.11	.32	.31	.31	.31	.31	0.00	0.00	.47	.13	.34	.34	.11	.32
100	.56	.14	.40	.38	.13	.33	.39	.39	.39	.39	0.00	0.00	.56	.14	.39	.38	.13	.32
200	.65	.14	.45	.42	.15	.34	.47	.47	.47	.47	0.00	0.00	.65	.14	.46	.42	.15	.32

STATISTICS OF AREAS

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
1520.0	24.3	177.0	288.5	420.5	1.46	324.00	324.00	324.00	324.00	0.00	0.00	1520.0	24.3	179.0	291.4	401.0	1.3

STATISTICS OF SKEWNESS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
.05	-.67	-.03	-.13	.22	-1.65	-.36	-.36	-.36	-.36	0.00	0.00	.05	-.67	-.07	-.15	.22	-1.45

STATISTICS OF KURTOSIS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
4.47	2.54	3.95	3.75	.65	.18	3.12	3.12	3.12	3.12	0.00	0.00	4.47	2.54	3.88	3.65	.64	.18

STATISTICS OF SP. MEAN (ARITHMETIC) / MEAN ANNUAL RUN OFF (MM.)/ BASE FLOW INDEX

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
.28	.09	.19		.06	.31	.12	.12	.12	.12	0.00	0.00	.28	.09	.17	.17	.06	.32
469.14	222.84	320.21	333.08	79.45	.24	253.70	253.70	253.70	253.70	0.00	0.00	469.14	222.84	313.72	326.47	79.14	.24
.82	.33	.49	.53	.15	.29	.50	.50	.50	.50	0.00	0.00	.82	.33	.49	.53	.15	.28

TABLE : A9.:

STATION PARAMETER STATISTICS FOR REGION 10

---NOTE--- THE FOLLOWING STATISTICS DO NOT INCLUDE DATA WHICH ARE LESS THAN 10 YEARS

TOTAL NUMBER OF STATIONS USED IN CALCULATIONS : 13 NATURAL: 11 REGULATED: 2

RETURN PERIOD	SP. DISCHARGE (NATURAL)						SP. DISCHARGE (REGULATED)						SP. DISCHARGE (TOTAL)					
	MAX	MIN	MED	MEAN	STD	CV	MAX	MIN	MED	MEAN	STD	CV	MAX	MIN	MED	MEAN	STD	CV
2	.18	.05	.10	.10	.04	.40	.08	.07	.08	.08	.00	.03	.18	.05	.10	.09	.04	.39
5	.24	.06	.13	.13	.06	.48	.10	.09	.10	.10	.00	.04	.24	.06	.12	.13	.06	.46
10	.31	.07	.14	.15	.08	.57	.11	.11	.11	.11	.01	.06	.31	.07	.13	.15	.07	.56
20	.40	.08	.15	.18	.10	.67	.13	.12	.12	.12	.01	.07	.40	.08	.14	.17	.10	.68
50	.55	.09	.17	.21	.14	.84	.14	.13	.14	.14	.01	.08	.55	.09	.15	.20	.13	.89
100	.69	.09	.18	.24	.18	1.00	.15	.14	.15	.15	.01	.09	.69	.09	.16	.22	.17	1.08
200	.86	.10	.19	.27	.23	1.19	.17	.14	.15	.15	.02	.10	.86	.10	.17	.25	.21	1.28

STATISTICS OF AREAS

NATURAL DATA ONLY						REGULATED DATA ONLY						ALL DATA INCLUDED					
MAX	MIN	MED	MEAN	STD	CV	MAX	MIN	MED	MEAN	STD	CV	MAX	MIN	MED	MEAN	STD	CV
8940.0	62.9	1780.0	2463.9	2389.1	.97	11900.0	6760.0	9330.0	9330.0	3634.5	.4	11900.0	62.9	1980.0	3520.2	3536.3	1.0

STATISTICS OF SKEWNESS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY						REGULATED DATA ONLY						ALL DATA INCLUDED					
MAX	MIN	MED	MEAN	STD	CV	MAX	MIN	MED	MEAN	STD	CV	MAX	MIN	MED	MEAN	STD	CV
.01	-.46	-.07	-.11	.13	-1.19	.00	-.01	-.01	-.01	.01	-2.26	.01	-.46	-.07	-.09	.12	-1.34

STATISTICS OF KURTOSIS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY						REGULATED DATA ONLY						ALL DATA INCLUDED					
MAX	MIN	MED	MEAN	STD	CV	MAX	MIN	MED	MEAN	STD	CV	MAX	MIN	MED	MEAN	STD	CV
5.40	2.72	3.31	3.57	.93	.26	3.33	3.07	3.20	3.20	.19	.06	5.40	2.72	3.31	3.51	.86	.24

STATISTICS OF SP. MEAN (ARITHMETIC) / MEAN ANNUAL RUN OFF (MM.)/ BASE FLOW INDEX

NATURAL DATA ONLY						REGULATED DATA ONLY						ALL DATA INCLUDED					
MAX	MIN	MED	MEAN	STD	CV	MAX	MIN	MED	MEAN	STD	CV	MAX	MIN	MED	MEAN	STD	CV
.19	.05	.11	.11	.05	.44	.08	.08	.08	.08	.00	.04	.19	.05	.10	.10	.04	.43
598.32	315.60	390.45	407.90	84.13	.21	384.03	362.43	373.23	373.23	15.28	.04	598.32	316.60	384.03	402.56	78.02	.19
.86	.53	.64	.69	.11	.16	.71	.68	.70	.70	.02	.03	.86	.53	.67	.69	.10	.15

TABLE : A10.1

STATION PARAMETER STATISTICS FOR REGION 11

---NOTE--- THE FOLLOWING STATISTICS DO NOT INCLUDE DATA WHICH ARE LESS THAN 10 YEARS

TOTAL NUMBER OF STATIONS USED IN CALCULATIONS : 31 NATURAL: 30 REGULATED: 1

RETURN PERIOD	SP. DISCHARGE (NATURAL) MAX	MIN	MED	MEAN	STD	CV	SP. DISCHARGE (REGULATED) MAX	MIN	MED	MEAN	STD	CV	SP. DISCHARGE (TOTAL) MAX	MIN	MED	MEAN	STD	CV
2	.19	.01	.03	.06	.05	1.72	.03	.03	.03	.03	0.00	0.00	.19	.01	.03	.05	.05	1.69
5	.29	.02	.04	.08	.08	1.92	.05	.05	.05	.05	0.00	0.00	.29	.02	.04	.08	.08	1.88
10	.39	.02	.05	.10	.11	2.07	.05	.05	.05	.05	0.00	0.00	.39	.02	.05	.10	.11	2.03
20	.47	.02	.06	.12	.14	2.24	.06	.06	.06	.06	0.00	0.00	.47	.02	.06	.12	.13	2.16
50	.61	.03	.07	.16	.18	2.35	.07	.07	.07	.07	0.00	0.00	.61	.03	.07	.15	.17	2.35
100	.74	.03	.09	.18	.21	2.45	.08	.08	.08	.08	0.00	0.00	.74	.03	.08	.18	.21	2.52
200	.87	.03	.09	.21	.24	2.62	.08	.08	.08	.08	0.00	0.00	.87	.03	.09	.20	.24	2.61

STATISTICS OF AREAS

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
24200.0	.7	4400.0	5585.2	5963.4	1.07	4510.0	4510.0	4510.0	4510.0		0.0	0.0	24200.0	.7	4450.0	5550.5	5866.4	1.0

STATISTICS OF SKEWNESS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
.43	-.74	-.06	-.09	.20	-2.23	.06	.06	.06	.06	0.00	0.00	.43	-.74	-.06	-.08	.19	-2.33

STATISTICS OF KURTOSIS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
6.07	2.34	3.28	3.60	.93	.26	4.17	4.17	4.17	4.17	0.00	0.00	6.07	2.34	3.35	3.61	.92	.25

STATISTICS OF SP. MEAN (ARITHMETIC) / MEAN ANNUAL RUN OFF (MM.)/ BASE FLOW INDEX

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
.21	.01	.03	.06	.06	.99	.04	.04	.04	.04	0.00	0.00	.21	.01	.03	.06	.06	.99
389.80	157.14	287.34	283.62	56.73	.20	274.94	274.34	274.94	274.34	0.00	0.00	389.80	157.14	287.32	283.34	55.80	.20
1.00	.36	.87	.81	.20	.25	.87	.87	.87	.87	0.00	0.00	1.00	.36	.87	.81	.20	.25

TABLE : A11.1

STATION PARAMETER STATISTICS FOR REGION 12

---NOTE--- THE FOLLOWING STATISTICS DO NOT INCLUDE DATA WHICH ARE LESS THAN 10 YEARS

TOTAL NUMBER OF STATIONS USED IN CALCULATIONS : 9 NATURAL: 8 REGULATED: 1

RETURN PERIOD	SP. DISCHARGE (NATURAL) MAX	MIN	MED	MEAN	STD	CV	SP. DISCHARGE (REGULATED) MAX	MIN	MED	MEAN	STD	CV	SP. DISCHARGE (TOTAL) MAX	MIN	MED	MEAN	STD	CV
2	.12	.03	.07	.07	.03	.49	.09	.09	.09	.09	0.00	0.00	.12	.03	.07	.07	.03	.46
5	.15	.04	.09	.09	.04	.46	.10	.10	.10	.10	0.00	0.00	.15	.04	.10	.09	.04	.40
10	.19	.04	.11	.10	.05	.45	.12	.12	.12	.12	0.00	0.00	.19	.04	.12	.11	.04	.39
20	.23	.05	.11	.12	.06	.49	.13	.13	.13	.13	0.00	0.00	.23	.05	.12	.12	.05	.42
50	.30	.05	.14	.14	.07	.51	.14	.14	.14	.14	0.00	0.00	.30	.05	.14	.14	.07	.47
100	.35	.05	.14	.16	.09	.60	.15	.15	.15	.15	0.00	0.00	.35	.05	.15	.16	.08	.53
200	.41	.06	.15	.18	.11	.72	.16	.16	.16	.16	0.00	0.00	.41	.06	.16	.18	.10	.63

STATISTICS OF AREAS

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
50000.0	4250.0	15750.0	19505.0	16540.4	.85	60100.0	60100.0	60100.0	60100.0	0.0	0.0	60100.0	4250.0	21100.0	24015.6	20554.6	.8

STATISTICS OF SKEWNESS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
-.02	-.69	-.29	-.27	.23	-.86	-.07	-.07	-.07	-.07	0.00	0.00	-.02	-.69	-.21	-.24	.22	-.92

STATISTICS OF KURTOSIS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
5.27	3.02	3.43	3.92	.75	.20	3.58	3.58	3.58	3.58	0.00	0.00	5.27	3.02	3.44	3.79	.70	.19

STATISTICS OF SP. MEAN (ARITHMETIC) / MEAN ANNUAL RUN OFF (MM.)/ BASE FLOW INDEX

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
.11	.03	.07	.07	.03	.47	.09	.09	.09	.09	0.00	0.00	.11	.03	.08	.07	.03	.44
429.64	216.59	299.04	311.06	61.46	.20	409.32	409.32	409.32	409.32	0.00	0.00	429.64	216.59	300.00	321.97	66.16	.21
.94	.53	.61	.69	.16	.23	.69	.69	.69	.69	0.00	0.00	.94	.53	.61	.69	.15	.21

TABLE : A12.1

DATA FOR STATIONS IN REGION 1

STATION NUMBER	DATA YEARS	TOT	AREA SQ.KM.	PREDICTED DISCHARGES (CMS) Q2	Q5	Q10	Q20	Q50	Q100	Q200	RECORDED MEAN	QMAX	QMIN	MAR MM.	BFI	CS	DISTRIBUTION PARAMETERS CK	SD	CSL	CKL	POR
02CA002	1971-83	13N	108.0	30.	43.	54.	67.	87.	105.	125.	34.	58.	20.	563.0	.352	.890	3.917	12.5	-.347	3.096	A62
02CF007	1962-82	21N	272.0	39.	48.	54.	60.	66.	71.	76.	40.	60.	24.	355.9	.548	-.108	2.888	9.8	-.515	2.696	C74
02CF009	1959-82*	24N	21.5	10.	13.	15.	18.	21.	23.	26.	11.	20.	7.	474.4	.268	1.098	4.548	3.3	-.112	3.071	A31
02CF011	1971-82	12N	704.0	57.	80.	99.	119.	149.	174.	201.	65.	149.	35.	456.0	.625	2.292	9.982	30.1	.162	5.813	A49
02DD008	1957-82	26N	90.6	20.	27.	32.	37.	43.	48.	53.	21.	50.	9.	576.3	.414	1.662	7.622	8.5	.063	4.216	A27
02EA005	1916-82	67N	321.0	43.	56.	64.	72.	81.	88.	95.	45.	96.	22.	551.4	.664	.855	4.499	14.5	-.017	3.101	A12
02EA006	1916-82*	67N	650.0	48.	54.	75.	86.	99.	110.	120.	51.	109.	23.	523.1	.758	.811	3.702	17.5	-.071	2.662	A24
02EA008	1946-57	12N	1850.0	128.	159.	118.	195.	215.	230.	245.	135.	199.	89.	490.3	.698	.570	5.436	33.3	-.039	5.103	B19
02EA010	1968-82	15N	149.0	29.	39.	48.	60.	78.	95.	115.	33.	52.	23.	625.5	.502	.998	4.028	9.0	-.426	2.953	A71
02HE001	1970-82	13N	13.9	3.85	5.50	6.63	7.73	9.19	10.31	11.47	4.15	6.44	1.60	389.9	.481	-.027	2.639	1.60	-.638	3.622	C85
02HE002	1970-82*	13N	114.0	30.	39.	46.	52.	60.	66.	71.	31.	62.	20.	417.5	.323	1.486	6.278	12.0	.819	3.957	C86
02HL004	1965-82	18N	712.0	74.	95.	110.	124.	142.	156.	171.	78.	139.	45.	368.3	.672	1.146	5.172	23.4	-.023	3.863	A16
02HL005	1966-82	17N	308.0	35.	44.	49.	55.	62.	67.	72.	36.	53.	23.	373.4	.531	.299	2.602	9.2	-.140	2.540	A34
02HM004	1972-82	11N	112.0	27.	35.	41.	47.	55.	61.	67.	29.	52.	17.	407.1	.374	1.623	7.147	9.5	.095	5.824	A39
02HM005	1973-82	10N	155.0	37.	49.	57.	66.	78.	87.	98.	40.	65.	24.	540.6	.494	1.190	4.984	12.8	-.015	5.054	A19
02KA003	1967-82	16N	6.0	.44	.52	.57	.62	.67	.71	.75	.45	.60	.30	311.7	.508	-.231	2.909	.10	-.543	2.944	C71
02KA004	1973-82	10N	.9	.10	.16	.22	.29	.40	.50	.61	.12	.34	.05	244.4	.387	2.513	1.563	.10	-.107	5.275	A39
02KA005	1968-83	16N	3.4	.35	.43	.48	.52	.57	.61	.65	.36	.48	.23	264.7	.367	-.081	2.680	.10	-.424	2.885	C72
02KA006	1970-82	13N	.8	.08	.10	.12	.13	.15	.16	.18	.08	.14	.05	187.5	.404	.811	4.409	0.00	.141	3.540	C45
02KA007	1973-82	10N	.2	.05	.07	.09	.11	.15	.19	.23	.05	.09	.03	450.0	.378	.549	3.374	0.00	-.432	3.346	A74
02KC014	1969-82	14N	443.0	43.	58.	68.	78.	92.	103.	115.	46.	81.	26.	345.4	.610	.921	4.490	15.4	-.119	3.493	A35
02KF011	1972-83	12N	269.0	60.	73.	82.	89.	98.	105.	112.	62.	96.	40.	358.0	.325	.979	5.976	14.5	.016	5.054	A19
02LA006	1970-82*	13N	409.0	65.	76.	82.	87.	94.	99.	104.	66.	82.	48.	413.2	.410	-.124	2.459	11.6	-.308	2.618	C64
02LA007	1970-83	14N	559.0	120.	134.	141.	145.	150.	152.	155.	120.	148.	55.	277.3	.380	-.691	5.020	18.6	-.030	4.718	B18
02CC004	1921-50	30R	9270.0	466.	558.	807.	966.	1195.	1384.	1589.	521.	1060.	267.	381.9	.840	1.016	3.999	199.5	-.169	2.705	A44
02CE002	1921-82	62R	1350.0	111.	152.	178.	203.	234.	257.	280.	118.	278.	37.	429.6	.769	1.256	5.421	46.8	.071	3.925	A26
02CF005	1959-82	24R	89.1	22.	29.	34.	38.	43.	47.	51.	24.	38.	13.	506.2	.373	.366	2.550	7.2	-.127	2.436	A35
02HF003	1966-82	17R	1270.0	112.	139.	157.	176.	201.	222.	242.	120.	191.	84.	464.6	.661	1.052	5.771	27.7	-.129	3.644	B35
02HM001	1952-73	22R	777.0	61.	80.	92.	102.	114.	123.	131.	64.	101.	30.	370.7	.644	.255	2.557	20.9	-.066	2.619	A24
02HM003	1959-82	24R	891.0	74.	96.	110.	123.	139.	151.	163.	77.	152.	35.	365.9	.770	1.152	5.893	25.3	.042	4.316	A27

TOTAL NUMBER OF STATIONS: 30 NATURAL: 24 REGULATED: 6

DATA FOR STATIONS IN REGION 2

STATION NUMBER	DATA YEARS	TOT	AREA SQ.KM.	PREDICTED DISCHARGES (CMS) Q2	Q5	Q10	Q20	Q50	Q100	Q200	RECORDED MEAN	QMAX	QMIN	MAR MM.	BFI	CS	DISTRIBUTION PARAMETERS CK	SD	CSL	CKL	POR
02LB005	1946-82*	37N	3810.0	800.	989.	1075.	1141.	1209.	1251.	1287.	784.	1269.	251.	349.1	.271	-.490	3.213	245.0	-.013	3.310	B14
02LB006	1948-82	35N	433.0	144.	197.	233.	268.	313.	348.	384.	157.	304.	75.	420.3	.301	.771	3.683	56.3	-.096	2.846	B32
02LB007	1948-82	35N	246.0	51.	72.	86.	98.	113.	124.	136.	54.	125.	18.	391.9	.388	.846	4.700	23.6	-.024	3.269	A13
02LB008	1949-82	27N	440.0	119.	181.	224.	266.	321.	364.	408.	135.	318.	37.	479.5	.301	1.047	4.150	72.1	-.018	3.171	D12
02LB009	1955-82*	28N	1050.0	204.	253.	276.	294.	314.	326.	337.	204.	302.	108.	498.1	.297	-.122	2.404	59.0	-.043	2.458	B25
02LB012	1970-83	14N	76.7	21.	28.	36.	46.	62.	78.	97.	24.	42.	10.	432.9	.258	1.203	5.869	7.3	-.375	3.814	B66
02MC001	1961-82	22N	404.0	92.	114.	126.	135.	145.	152.	158.	93.	146.	40.	403.5	.365	-.115	3.549	26.8	-.007	3.591	B15

TOTAL NUMBER OF STATIONS: 7 NATURAL: 7 REGULATED: 0

* - DENOTES STATION HAVING MINOR REGULATION (CLASSIFIED AS NATURAL FOR CALCULATIONS)

TABLE : A.13.1

DATA FOR STATIONS IN REGION 3

STATION NUMBER	DATA YEARS	TOT	AREA SQ.KM.	PREDICTED DISCHARGES (CMS) Q2	Q5	Q10	Q20	Q50	Q100	Q200	RECORDED MEAN	QMAX	QMIN	PAR MM.	BFI	CS	DISTRIBUTION PARAMETERS CK	SD	CSL	CKL	POR
02ED013	1949-82	34N	1180.	121.	181.	227.	266.	325.	372.	421.	136.	370.	42.	255.1	.550	1.718	6.851	69.8	.064	3.876	A26
02ED005	1964-82*	19N	395.	54.	78.	94.	110.	132.	149.	166.	59.	129.	24.	423.7	.608	1.213	5.138	26.5	-.012	3.092	A16
02ED102	1969-82	14N	270.	44.	70.	89.	109.	135.	158.	181.	51.	122.	23.	304.7	.531	1.246	4.344	31.2	.627	3.452	C81
02ED103	1969-82	14N	195.	22.	33.	43.	54.	70.	84.	99.	25.	53.	12.	379.5	.710	1.113	4.771	11.7	-.246	3.272	A53
02FA001	1958-82	25N	927.	122.	162.	188.	213.	244.	267.	291.	128.	203.	60.	462.8	.615	-.028	2.495	39.6	-.587	3.021	C71
02FB007	1946-82	37N	181.	36.	52.	63.	74.	88.	98.	109.	39.	99.	11.	503.3	.564	1.204	5.404	18.3	-.003	3.418	A14
02FB010	1958-82*	25N	295.	65.	96.	120.	149.	192.	228.	270.	76.	132.	39.	481.2	.546	.587	2.598	29.1	-.279	2.651	B54
02FC001	1916-82	67N	3963.	561.	767.	878.	991.	1131.	1237.	1334.	589.	1162.	197.	449.5	.643	.652	3.228	216.1	-.024	2.932	A11
02FC002	1916-82	67N	2150.	311.	435.	522.	609.	726.	817.	912.	340.	774.	137.	443.3	.623	1.306	4.866	140.2	0.000	3.227	A13
02FC004	1916-40	25N	249.	18.	24.	28.	32.	38.	42.	46.	19.	49.	4.	445.8	.813	2.268	1.721	8.0	.236	6.307	B59
02FC011	1954-82	29N	163.	32.	48.	58.	69.	82.	93.	103.	36.	82.	10.	404.3	.509	1.202	4.497	17.4	.035	3.600	A16
02FC015	1972-82	11N	663.	100.	124.	139.	153.	171.	183.	196.	103.	142.	70.	512.8	.619	.247	2.486	26.7	.058	2.391	C25
02ED100	1969-82	14R	86.	12.	18.	22.	27.	34.	40.	47.	14.	26.	7.	209.3	.572	.910	3.874	5.7	-.200	3.272	A53
02FC012	1972-82	11R	535.	109.	219.	253.	286.	328.	361.	394.	178.	251.	105.	464.6	.415	.234	2.588	51.8	-.173	2.981	A41
02FC013	1972-82	11R	262.	37.	48.	56.	64.	74.	82.	91.	40.	69.	25.	549.6	.674	1.483	7.272	11.9	-.032	4.822	A18

TOTAL NUMBER OF STATIONS: 15 NATURAL: 12 REGULATED: 3

* - DENOTES STATION HAVING MINOR REGULATION (CLASSIFIED AS NATURAL FOR CALCULATIONS)

TABLE : A.13.2

DATA FOR STATIONS IN REGION 4

STATION NUMBER	DATA YEARS		AREA SQ.KM.	PREDICTED DISCHARGES (CMS) Q2	Q5	Q10	Q20	Q50	Q100	Q200	RECORDED MEAN	QMAX	QMIN	MAR PM.	BFI	CS	DISTRIBUTION PARAMETERS CK	SD	CSL	CKL	POR
02FE002	1953-82	30N	1630.0	394.	561.	664.	758.	875.	961.	1044.	416.	776.	142.	420.9	.407	.279	2.405	180.4	-.096	2.311	A35
02FE004	1946-82	37N	1760.0	438.	640.	770.	893.	1051.	1168.	1296.	473.	1119.	123.	436.4	.457	.793	3.944	220.2	-.048	2.987	A21
02FE008	1971-82	12N	648.0	182.	240.	275.	307.	347.	375.	402.	109.	306.	90.	432.1	.334	.326	3.348	63.7	-.075	3.351	A24
02FE009	1971-82	12N	376.0	103.	147.	184.	224.	284.	326.	391.	116.	181.	63.	484.0	.315	.502	2.594	42.9	-.269	3.166	A52
02FE010	1968-79	12N	197.0	55.	77.	93.	109.	130.	147.	164.	60.	109.	30.	388.8	.258	.858	4.383	23.3	-.128	3.681	A35
02GA001	1913-23	11N	760.0	192.	275.	327.	375.	436.	482.	527.	215.	338.	99.	321.1	.299	.261	3.900	84.2	-.146	3.095	B46
02GA003	1914-79	56N	3533.0	713.	1122.	1398.	1637.	1815.	1994.	2166.	766.	1662.	204.	312.5	.493	.763	3.489	330.5	-.048	2.793	A23
02GA010	1948-82	35N	1030.0	247.	329.	377.	420.	471.	507.	542.	259.	428.	92.	334.6	.488	.299	2.662	98.0	-.044	2.763	B23
02GA015	1951-79	29N	593.0	69.	107.	133.	159.	194.	221.	249.	78.	166.	18.	303.5	.545	.796	3.191	40.2	-.076	2.949	A21
02GA016	1948-79	32N	800.0	245.	364.	444.	521.	623.	701.	780.	269.	731.	91.	338.8	.527	1.306	6.848	131.4	-.058	3.200	A23
02GA017	1951-72	22N	324.0	150.	195.	218.	237.	259.	274.	287.	93.	260.	47.	351.9	.228	.037	3.554	51.4	-.002	3.556	B15
02GA018	1951-82	32N	552.0	210.	298.	363.	403.	466.	511.	557.	223.	453.	70.	342.4	.299	.449	2.939	95.8	-.071	2.640	A24
02GA030	1966-82*	17N	49.7	10.00	15.00	19.00	24.00	30.00	34.00	39.00	11.00	22.00	3.00	136.4	.364	.675	3.000	5.90	-.150	3.012	A41
02GA031	1969-82*	14N	44.5	5.00	7.00	8.00	9.00	11.00	11.00	12.00	5.00	9.00	2.00	418.0	.732	.133	2.854	2.20	-.052	2.781	A23
02GA032	1970-82	13N	2.6	2.20	4.62	6.81	9.37	13.42	17.08	21.28	5.00	8.92	.33	296.0	.252	1.464	9.206	2.40	-.574	4.383	C77
02GA035	1971-83	13N	27.7	15.	21.	25.	30.	35.	40.	44.	16.	27.	7.	371.8	.432	.289	2.757	6.7	-.188	2.694	A44
02GA036	1971-83	13N	17.9	15.	22.	26.	30.	35.	39.	42.	16.	28.	5.	413.4	.196	.184	2.569	7.4	-.123	2.678	A34
02GA037	1972-83	12N	25.1	16.	25.	32.	39.	50.	59.	68.	18.	41.	7.	446.2	.317	1.270	6.151	9.4	-.179	3.712	A46
02GA038	1972-82	11N	326.0	204.	268.	309.	347.	397.	433.	470.	213.	289.	135.	349.7	.187	-.253	2.191	64.2	-.382	2.213	C66
02GA039	1973-82	10N	292.0	207.	291.	347.	402.	474.	529.	585.	223.	388.	125.	419.1	.197	.554	3.737	88.8	-.049	2.946	C21
02GA040	1974-83*	10N	167.0	60.	89.	108.	128.	153.	173.	193.	65.	114.	28.	397.6	.390	.356	3.394	29.3	-.204	3.151	A52
02GB001	1948-79	32N	5210.0	928.	1337.	1588.	1817.	2103.	2310.	2513.	982.	1833.	264.	332.1	.550	.357	2.557	444.2	-.076	2.514	A24
02GB002	1914-23*	10N	5910.0	815.	976.	1079.	1177.	1302.	1396.	1490.	462.	1284.	615.	318.1	.479	1.628	1.600	180.0	.112	9.453	B39
02GB006	1954-82*	29N	150.0	35.	49.	58.	67.	79.	89.	98.	38.	78.	16.	378.7	.484	1.116	4.775	15.1	-.018	3.617	B15
02GB007	1965-82	18N	360.0	58.	63.	71.	77.	85.	90.	95.	50.	77.	22.	308.3	.419	.137	2.824	15.7	-.027	2.897	A12
02GB008	1962-82*	21N	383.0	56.	71.	80.	87.	95.	101.	106.	57.	92.	24.	344.6	.546	.155	3.395	17.6	-.015	3.422	B14
02GB009	1962-82	21N	91.9	36.	55.	69.	83.	102.	118.	134.	40.	89.	14.	353.6	.328	.003	3.773	20.1	-.122	3.043	A31
02GB011	1964-76	13N	29.0	4.00	10.00	15.00	21.00	32.00	42.00	54.00	6.00	19.00	1.00	271.4	.694	1.335	4.697	5.80	-.246	3.697	A56
02GD001	1916-66	51N	134.0	200.	314.	392.	470.	574.	654.	737.	226.	613.	39.	335.8	.507	1.950	9.539	134.0	-.050	3.801	A26
02GD003	1316-44	29N	1450.0	364.	487.	558.	616.	687.	735.	782.	379.	718.	114.	354.1	.385	.287	3.526	137.4	-.021	3.194	B13
02GD010	1946-82	37N	150.0	56.	84.	102.	121.	145.	164.	183.	63.	150.	8.	384.0	.353	1.304	5.062	30.8	-.032	3.801	B16
02GD012	1952-64	13N	854.0	49.	94.	134.	179.	248.	309.	379.	64.	169.	14.	347.2	.411	1.340	5.093	47.5	-.214	3.664	A55
02GD019	1967-82	16N	36.6	19.	24.	29.	34.	43.	52.	62.	21.	44.	16.	477.8	.276	3.038	4.399	6.7	-.140	4.153	A37
02GD020	1966-82	17N	108.0	36.	50.	59.	67.	77.	85.	93.	38.	70.	15.	314.8	.358	.760	3.991	14.9	-.035	3.667	A15
02FE003	1951-79	27R	77.7	36.	51.	61.	69.	80.	88.	96.	39.	79.	8.	386.1	.283	.665	3.686	17.0	-.008	3.673	B15
02FE005	1953-82	30R	528.0	159.	248.	307.	362.	434.	488.	543.	175.	374.	36.	424.2	.458	.448	2.581	94.4	-.111	2.494	A35
02FE007	1968-82	15R	326.0	102.	152.	186.	220.	267.	303.	340.	113.	201.	50.	463.2	.402	.599	2.969	51.8	.005	2.590	C14
02GA022	1953-84	12R	655.0	156.	208.	241.	273.	311.	340.	369.	169.	289.	88.	299.2	.266	.823	6.084	55.4	-.037	5.324	B19
02GA033	1956-82	46R	97.8	13.00	23.00	29.00	35.00	41.00	47.00	53.00	15.00	42.00	3.00	344.1	.455	1.508	6.877	8.3	-.032	4.845	B17
02GB310	1962-82	21R	1710.0	22.	29.	33.	37.	41.	44.	47.	23.	43.	9.	301.2	.361	.384	4.229	8.2	-.003	3.803	A16
02GD004	1946-82	37R	306.0	93.	149.	188.	226.	279.	318.	360.	106.	412.	18.	369.3	.404	2.507	3.313	68.9	-.096	4.427	A37
02GD005	1946-82	35R	1080.0	429.	580.	659.	725.	799.	849.	895.	438.	770.	199.	379.6	.321	.036	2.678	174.0	-.006	2.673	B14
02GD008	1973-82	10R	200.0	94.	118.	133.	146.	161.	172.	183.	86.	146.	57.	387.0	.348	.342	4.134	26.8	-.061	3.866	A26
02GD011	1952-82	31R	93.2	23.	39.	50.	62.	79.	93.	108.	28.	68.	6.	315.5	.356	1.852	3.518	16.7	-.066	3.096	A22
02GD014	1955-82	28R	319.0	217.	304.	362.	417.	490.	545.	601.	238.	447.	99.	416.9	.262	.762	3.311	93.2	-.038	3.341	A14
02GD015	1954-82	29R	1340.0	508.	650.	718.	772.	830.	867.	899.	506.	867.	142.	385.8	.371	-.259	3.198	173.6	-.014	3.296	A14
02GD018	1965-82	18R	144.0	56.	74.	86.	99.	115.	128.	141.	60.	97.	34.	436.6	.343	.535	3.078	18.7	-.164	2.699	A44

TOTAL NUMBER OF STATIONS: 47 NATURAL: 34 REGULATED: 13

* - DENOTES STATION HAVING MINOR REGULATION (CLASSIFIED AS NATURAL FOR CALCULATIONS)

TABLE : A.13.3

DATA FOR STATIONS IN REGION 5

STATION NUMBER	DATA YEARS	TOT	AREA SQ.KM.	PREDICTED DISCHARGES (CMS) Q2	Q5	Q10	Q20	Q50	Q100	Q200	RECORDED MEAN	QMAX	QMIN	MAR MM.	DISTRIBUTION PARAMETERS BFI	CS	CK	SD	CSL	CKL	PDR
02FD001	1974-83	10N	154.0	87.	130.	158.	185.	220.	247.	275.	100.	196.	39.	431.8	.236	1.073	8.139	45.5	-.040	6.712	B19
02FF002	1948-82	35N	466.0	207.	291.	347.	401.	473.	527.	582.	226.	423.	89.	358.4	.365	.669	3.072	89.3	-.084	2.865	B22
02FF004	1966-82	17N	41.4	24.	31.	36.	39.	44.	47.	50.	22.	42.	12.	364.7	.185	.418	3.626	7.8	-.034	3.423	A14
02FF006	1957-69	13N	33.7	10.00	20.00	27.00	34.00	46.00	55.00	65.00	13.00	28.00	2.00	365.0	.190	.530	2.735	8.70	-.246	3.046	A51
02FF007	1967-82	16N	466.0	174.	228.	263.	296.	339.	371.	403.	183.	311.	101.	397.0	.332	.910	4.665	59.4	-.037	3.840	A16
02FF008	1973-82	10N	110.0	34.	40.	43.	46.	49.	51.	53.	34.	45.	27.	427.3	.172	.356	3.068	6.3	-.232	2.919	A51
02GE005	1966-82	17N	140.0	35.	47.	56.	64.	74.	82.	90.	37.	69.	18.	416.4	.294	1.053	5.046	13.7	-.040	3.805	A16
02GG002	1949-82	34N	730.0	113.	154.	179.	204.	235.	258.	281.	121.	238.	43.	420.5	.418	1.113	4.870	45.4	-.052	4.133	B27
02GG004	1965-82	18N	609.0	94.	138.	170.	202.	248.	284.	322.	105.	225.	49.	287.4	.265	1.004	5.030	45.7	-.178	2.942	A41
02GG005	1967-82	16N	172.0	33.	46.	57.	69.	87.	102.	118.	38.	99.	21.	355.8	.468	2.739	2.343	18.4	-.170	5.342	A49
02GG007	1967-82	16N	1240.0	144.	188.	223.	256.	312.	356.	404.	158.	326.	98.	312.1	.365	2.157	8.480	57.2	-.931	5.326	A59
02GH001	1972-82	12N	14.2	15.00	24.00	31.00	39.00	51.00	61.00	71.00	19.00	37.00	3.00	412.7	.390	1.054	5.399	9.30	-.211	4.526	B58
02GH002	1972-83	12N	125.0	55.	76.	89.	103.	120.	132.	145.	58.	102.	27.	286.4	.151	.757	4.178	22.5	-.066	3.985	A26
02GE002	1966-82	28R	3110.0	668.	831.	905.	960.	1018.	1054.	1085.	657.	877.	288.	376.2	.451	-.356	3.983	208.1	-.056	2.859	B22
02GE003	1965-82	28R	4080.0	545.	702.	786.	856.	947.	991.	1042.	557.	960.	229.	367.4	.493	.103	3.233	179.3	-.009	3.163	B12
02GE006	1973-82	10R	3760.0	522.	642.	779.	966.	1309.	1658.	2103.	576.	940.	464.	436.2	.511	2.210	9.697	141.9	-.357	4.561	A68

TOTAL NUMBER OF STATIONS: 17 NATURAL: 14 REGULATED: 3

DATA FOR STATIONS IN REGION 6

STATION NUMBER	DATA YEARS	TOT	AREA SQ.KM.	PREDICTED DISCHARGES (CMS) Q2	Q5	Q10	Q20	Q50	Q100	Q200	RECORDED MEAN	QMAX	QMIN	MAR MM.	DISTRIBUTION PARAMETERS BFI	CS	CK	SD	CSL	CKL	PDR
02GC004	1955-75*	21N	597.0	65.	104.	132.	162.	203.	236.	271.	75.	210.	17.	348.6	.601	1.784	6.478	47.4	.125	4.647	A38
02GC007	1956-82*	27N	591.0	43.	72.	99.	129.	177.	219.	266.	53.	252.	13.	335.0	.753	3.100	4.785	48.0	.208	4.588	A56
02GC011	1964-78*	15N	142.0	30.	46.	56.	67.	80.	91.	102.	34.	62.	12.	331.0	.529	.396	2.972	15.9	-.155	3.291	B44
02GC012	1964-82*	19N	51.3	5.00	7.00	9.00	10.00	13.00	14.00	16.00	5.00	14.00	2.00	419.1	.801	1.925	9.586	2.70	-.047	4.014	C27
02GC013	1964-82*	19N	104.0	12.	17.	21.	24.	29.	33.	37.	13.	26.	6.	438.5	.672	.738	3.068	5.0	-.126	3.361	A31
02GC016	1965-77*	13N	109.0	15.	25.	33.	42.	56.	67.	80.	18.	37.	6.	409.2	.589	.692	3.341	9.6	-.264	3.122	A52
02GC018	1965-82	18N	287.0	113.	143.	162.	180.	201.	217.	233.	117.	151.	99.	393.7	.277	-.649	2.728	28.9	-.995	3.640	C95
02GC002	1967-82	16R	329.0	135.	182.	216.	250.	297.	333.	372.	146.	275.	79.	367.8	.258	1.075	5.887	50.4	-.097	3.474	A34
02GC005	1956-82	27R	363.0	33.	56.	78.	99.	130.	156.	185.	41.	148.	10.	327.8	.694	2.136	9.526	29.3	-.073	3.489	A24
02GC008	1956-82	25R	134.0	17.	28.	36.	44.	56.	65.	75.	20.	61.	5.	373.9	.726	1.554	7.400	11.9	-.105	3.171	A32
02GC010	1961-82	22R	342.0	60.	91.	114.	136.	165.	189.	213.	67.	146.	17.	353.8	.522	.895	3.415	34.3	-.037	3.384	A14
02GC013	1964-82	19R	75.9	14.	23.	29.	34.	41.	47.	52.	16.	41.	6.	400.5	.481	1.197	4.668	9.9	.584	3.007	A71
02GC014	1967-78	12R	65.8	6.00	10.00	12.00	15.00	19.00	23.00	26.00	7.00	13.00	2.00	378.8	.767	.435	2.624	3.6	-.211	3.135	A52
02GC017	1965-82	18R	93.2	22.	30.	34.	39.	43.	47.	50.	22.	39.	8.	389.5	.497	.124	2.458	9.1	-.061	2.433	A25

TOTAL NUMBER OF STATIONS: 14 NATURAL: 7 REGULATED: 7

* - DENOTES STATION HAVING MINOR REGULATION (CLASSIFIED AS NATURAL FOR CALCULATIONS)

TABLE : A.13.4

DATA FOR STATIONS IN REGION 7

STATION NUMBER	DATA YEARS	TOT	AREA SQ.KM.	PREDICTED DISCHARGES (CMS) Q2	Q5	Q10	Q20	Q50	Q100	Q200	MEAN	RECORDED QMAX	QMIN	MAR MM.	DISTRIBUTION PARAMETERS BFI	CS	CK	SD	CSL	CKL	POR
02MA006	1957-82	26N	293.0	73.	103.	116.	131.	148.	161.	174.	76.	143.	25.	301.7	.151	.556	3.650	29.7	-.025	3.281	A13
02MB010	1961-70	10N	166.6	21.	29.	33.	38.	43.	47.	50.	22.	34.	9.	345.2	.515	.195	2.960	8.5	-.097	3.279	A33
02MB012	1972-82	11N	82.6	25.	34.	38.	42.	47.	50.	54.	26.	45.	11.	348.7	.451	.373	4.931	9.3	-.015	4.517	A18
02MA007	1958-82	26R	2[illegible].0	44.	64.	74.	84.	97.	106.	116.	54.	107.	22.	300.9	.182	1.445	6.649	16.3	.066	4.413	A27
02MB004	1957-82	26R	196.0	59.	84.	100.	116.	136.	151.	166.	63.	162.	21.	244.7	.260	1.588	8.072	26.6	.044	4.258	A27
02MB005	1959-82	24R	95.6	17.	23.	28.	32.	38.	43.	48.	18.	45.	8.	394.4	.528	1.835	9.531	7.6	-.020	3.839	A16
02MB011	1964-82	19R	235.0	23.	29.	32.	36.	40.	42.	45.	24.	34.	14.	361.7	.639	-.062	2.866	5.9	-.508	2.975	C71
02MB015	1973-82	10R	63.5	6.00	9.00	9.00	10.00	11.00	12.00	13.00	6.00	10.00	3.00	348.0	.627	.961	5.166	2.1	.013	5.391	A19

TOTAL NUMBER OF STATIONS: 9 NATURAL: 3 REGULATED: 5

DATA FOR STATIONS IN REGION 8

STATION NUMBER	DATA YEARS	TOT	AREA SQ.KM.	PREDICTED DISCHARGES (CMS) Q2	Q5	Q10	Q20	Q50	Q100	Q200	MEAN	RECORDED QMAX	QMIN	MAR MM.	DISTRIBUTION PARAMETERS BFI	CS	CK	SD	CSL	CKL	POR
02HB002	1946-82	37N	795.0	150.	245.	316.	390.	494.	579.	669.	178.	616.	12.	315.7	.574	2.121	8.341	120.4	.153	4.269	A47
02MB008	1963-82	20N	127.[illegible]	16.	23.	27.	30.	34.	37.	40.	17.	33.	9.	323.6	.566	.364	3.342	7.1	-.057	3.989	A22
02MC002	1946-82	16N	161.[illegible]	144.	201.	230.	259.	273.	296.	311.	148.	252.	22.	240.4	.191	-.036	2.999	66.4	-.115	3.085	B11
02MC003	1952-82	31N	803.[illegible]	126.	222.	296.	376.	494.	597.	711.	172.	1449.	25.	225.0	.450	5.171	1.794	240.2	-.620	4.160	B09
02MC006	1943-77	29N	240.[illegible]	76.	109.	127.	143.	163.	176.	189.	80.	151.	25.	348.6	.535	.198	2.729	39.8	-.051	2.562	B24
02MC009	1954-82	29N	197.[illegible]	27.	46.	61.	77.	96.	112.	130.	32.	121.	6.	185.3	.437	2.227	4.123	22.5	-.049	3.581	A25
02MC012	1957-81	25N	149.[illegible]	30.	50.	67.	86.	112.	134.	160.	44.	133.	7.	179.0	.601	1.834	4.659	17.8	-.032	3.616	A15
02MC017	1967-82	16N	63.[illegible]	39.	54.	74.	95.	127.	154.	183.	54.	153.	9.	519.9	.425	2.548	1.688	11.9	-.058	3.340	D27
02MC018	1966-82	17N	186.0	26.	37.	43.	48.	54.	58.	63.	22.	23.	19.	284.8	.261	.674	3.873	10.3	-.177	3.348	B44
02MC019	1966-82	17N	93.[illegible]	34.	50.	63.	76.	86.	96.	106.	29.	56.	12.	257.5	.457	.824	5.583	10.3	.081	4.209	A17
02MC023	1969-81	13N	62.[illegible]	16.	23.	28.	33.	40.	46.	52.	20.	113.	11.	402.1	.577	1.913	8.619	10.3	.026	4.420	A17
02MC025	1963-82	20N	103.0	34.	50.	67.	86.	112.	134.	160.	44.	133.	7.	242.8	.566	.458	3.014	15.7	-.021	4.037	D18
02MC027	1973-82	10N	58.[illegible]	31.	46.	63.	81.	100.	116.	132.	39.	116.	14.	254.5	.590	2.237	.595	22.3	-.824	4.342	A17
02MC028	1964-82	19N	97.[illegible]	34.	50.	67.	84.	107.	120.	133.	55.	89.	11.	432.8	.331	.795	4.620	17.1	-.151	3.915	A46
02MC029	1955-82	28N	130.[illegible]	34.	50.	67.	84.	107.	119.	131.	55.	89.	11.	314.0	.340	.065	2.961	6.6	-.016	3.017	D11
02MC030	1967-82	16N	204.0	80.	113.	138.	165.	202.	233.	266.	89.	163.	46.	346.9	.434	.383	2.443	21.1	-.176	2.258	A46
02MC034	1966-82	17N	148.[illegible]	39.	57.	73.	88.	106.	121.	136.	43.	89.	15.	323.5	.238	1.256	5.120	34.8	-.123	3.621	A34
02MC035	1966-82	17N	94.[illegible]	14.	18.	21.	24.	27.	28.	29.	9.	24.	7.	188.8	.227	1.888	5.123	14.3	-.169	3.095	A42
02MC033	1966-82	17N	63.2	30.	41.	48.	55.	65.	72.	80.	32.	50.	16.	381.3	.254	.545	3.728	4.6	-.026	3.660	B15
02MD002	1954-75	22N	262.0	55.	102.	143.	190.	262.	326.	398.	72.	238.	16.	404.6	.642	1.826	6.842	55.5	-.082	3.508	A25
02MD003	1960-82*	23N	67.3	17.	26.	34.	42.	54.	65.	76.	20.	56.	8.	527.5	.699	1.977	7.937	11.2	-.042	3.703	A26
02MD004	1960-82*	23N	42.7	13.10	26.54	38.05	51.08	71.01	88.32	107.88	17.86	61.20	1.69	358.3	.645	1.842	6.795	15.80	-.098	3.480	A34
02MD007	1960-82	23N	77.7	25.	45.	62.	80.	107.	130.	156.	33.	155.	6.	334.6	.545	3.322	6.714	30.0	-.185	4.963	A48
02MD008	1960-82	23N	95.8	37.	64.	86.	109.	143.	172.	203.	47.	145.	4.	376.8	.574	1.683	7.513	31.0	-.053	3.749	B26
02MD009	1966-82	17N	82.6	19.	32.	45.	60.	83.	104.	128.	25.	115.	7.	359.6	.619	3.472	6.828	24.5	.233	5.666	A59
02MD010	1966-82	17N	64.8	16.	25.	32.	44.	58.	70.	83.	20.	75.	8.	407.4	.617	3.269	5.729	15.2	.170	5.561	A49
02MD211	1969-78	10N	6.2	1.32	2.87	3.58	4.32	5.37	6.22	7.15	2.32	5.09	.52	135.5	.590	2.252	2.993	1.10	1.319	8.148	B99
02MD214	1967-78	12N	26.2	8.	14.	19.	25.	34.	42.	51.	10.	20.	4.	304.6	.580	.760	3.577	5.4	-.354	3.164	A62
02MD221	1968-77	10N	4.9	2.24	4.13	5.54	7.00	9.04	10.66	12.44	2.69	6.74	.37	255.1	.550	.881	5.337	1.90	-.227	3.617	A55
02MD223	1956-77	12N	17.4	5.92	9.38	12.85	17.19	24.55	31.53	39.92	7.73	18.15	1.25	285.1	.540	1.835	8.107	4.40	-.108	2.617	B39
02MD224	1967-77	10N	14.0	12.	18.	25.	33.	48.	62.	79.	15.	28.	3.	230.7	.560	1.331	6.371	6.9	-.303	5.967	B69
02MD232	1966-76	11N	27.2	3.83	7.10	10.04	13.47	18.88	23.70	29.26	4.89	11.04	1.46	273.5	.550	.832	4.153	3.00	-.374	3.333	A64
02MD233	1968-77	10N	21.0	7.10	11.40	14.91	18.77	24.52	29.41	34.83	8.83	18.41	1.71	162.9	.560	1.307	8.802	4.40	-.276	5.337	B59
02MB001	1925-82	58R	205.0	22.	32.	41.	48.	58.	66.	75.	25.	65.	7.	271.2	.651	1.429	5.557	12.4	.026	3.510	B15
02MC024	1972-82	11R	316.0	141.	156.	166.	171.	176.	179.	181.	140.	174.	93.	375.7	.486	-.832	5.493	24.8	-.055	5.619	B29
02MD006	1960-82	23R	82.9	26.	45.	61.	81.	111.	138.	169.	33.	139.	10.	482.5	.590	2.904	3.198	27.8	.092	4.345	A37

TOTAL NUMBER OF STATIONS: 37 NATURAL: 34 REGULATED: 3

* - DENOTES STATION HAVING MINOR REGULATION (CLASSIFIED AS NATURAL FOR CALCULATIONS)
= - DENOTES STATION HAVING HEAVY REGULATION (USED TO IMPROVE DATA RANGE)

TABLE : A.13.5

DATA FOR STATIONS IN REGION 9

STATION NUMBER	DATA YEARS	TOT	AREA SQ.KM.	PREDICTED DISCHARGES (CMS) Q2	Q5	Q10	Q20	Q50	Q100	Q200	RECORDED MEAN	QMAX	QMIN	MAR MM.	BFI	CS	DISTRIBUTION PARAMETERS CK	SD	CSL	CKL	POR
02EC002	1916-82	67N	1520.0	130.	156.	171.	184.	198.	209.	218.	132.	229.	60.	454.6	.693	.372	4.162	30.5	.014	3.816	B16
02EC009	1966-82	17N	181.0	32.	47.	57.	67.	81.	92.	103.	36.	88.	14.	240.3	.468	1.896	9.263	16.7	.020	4.468	A17
02EC010	1967-82	16N	42.9	10.	13.	15.	16.	18.	20.	21.	10.	15.	6.	222.8	.346	-.027	2.418	2.9	-.369	2.537	C24
02EC011	1967-82	16N	282.0	54.	65.	72.	78.	86.	92.	98.	56.	75.	39.	322.7	.455	.322	2.831	11.4	-.113	3.189	B32
02EC101	1971-82*	12N	24.3	3.11	4.94	6.28	7.66	9.58	11.11	12.74	3.56	8.51	1.25	469.1	.824	1.404	7.120	2.00	-.137	3.947	A36
02EC103	1970-82	13N	332.0	42.	61.	74.	87.	105.	118.	132.	46.	70.	20.	307.2	.569	-.157	2.726	17.7	-.669	3.057	C81
02ED007	1966-82	17N	177.0	32.	41.	46.	51.	57.	62.	66.	33.	57.	17.	407.9	.632	.877	4.745	9.7	.021	4.366	A17
02ED009	1973-83	11N	95.0	27.	33.	36.	39.	42.	44.	46.	27.	40.	16.	294.7	.329	.199	4.349	6.7	-.012	4.304	A17
02ED010	1973-82	10N	127.0	15.	17.	19.	20.	21.	23.	23.	15.	20.	10.	302.4	.488	.180	4.049	3.1	-.027	4.002	A17
02HJ001	1963-82	20N	110.0	19.	27.	34.	41.	52.	62.	72.	21.	50.	11.	321.8	.401	1.763	6.355	9.9	.048	4.033	A27
02HJ007	1971-82*	12N	282.0	40.	57.	69.	81.	99.	112.	127.	44.	68.	23.	320.2	.623	.415	2.815	16.2	-.238	2.956	A51
02EC012	1970-82	13R	324.0	33.	48.	61.	77.	102.	125.	151.	38.	67.	23.	253.7	.496	.852	3.862	13.5	-.355	3.121	A62

TOTAL NUMBER OF STATIONS: 12 NATURAL: 11 REGULATED: 1

DATA FOR STATIONS IN REGION 10

STATION NUMBER	DATA YEARS	TOT	AREA SQ.KM.	PREDICTED DISCHARGES (CMS) Q2	Q5	Q10	Q20	Q50	Q100	Q200	RECORDED MEAN	QMAX	QMIN	MAR MM.	BFI	CS	DISTRIBUTION PARAMETERS CK	SD	CSL	CKL	POR
02BA002	1970-82	13N	1190.0	79.	95.	101.	107.	112.	115.	118.	79.	109.	40.	396.6	.840	-.453	4.742	19.4	-.051	4.408	B27
02BA003	1973-82	10N	1320.0	139.	205.	248.	290.	343.	384.	426.	151.	272.	55.	365.2	.624	.510	3.716	69.0	-.121	3.762	A36
02BB002	1968-82	15N	1980.0	206.	244.	264.	281.	300.	312.	324.	210.	302.	122.	449.0	.640	.078	5.415	43.6	.002	5.398	B19
02BB001	1968-83	16N	1190.0	187.	277.	365.	474.	655.	825.	1029.	219.	460.	130.	596.3	.529	1.498	7.196	84.1	-.460	2.860	A72
02BF002	1964-82	15N	1160.0	203.	276.	325.	373.	436.	484.	533.	217.	370.	114.	516.4	.573	.574	3.399	76.7	-.134	3.037	A31
02JC008	1973-82	10N	1780.0	185.	227.	253.	276.	306.	328.	349.	190.	268.	126.	390.4	.635	.268	3.386	44.8	-.115	3.307	A34
02JE015	1973-82	10N	62.9	6.00	9.00	11.00	13.00	16.00	18.00	21.00	7.00	14.00	3.00	335.5	.631	1.576	8.096	3.10	-.086	4.806	A28
04JA002	1951-82	32N	3780.0	226.	270.	297.	321.	352.	375.	397.	234.	341.	156.	402.1	.856	.428	3.005	47.1	-.074	2.722	B23
04JC002	1951-82	32N	2410.0	119.	149.	168.	186.	209.	226.	242.	123.	199.	68.	316.9	.813	.483	2.687	33.1	-.064	2.750	A23
04JC003	1951-82	32N	3290.0	207.	257.	289.	319.	357.	384.	410.	215.	343.	123.	346.5	.754	.526	2.932	54.2	-.069	2.741	A23
04LJ001	1920-82	53N	8940.0	888.	1124.	1260.	1381.	1525.	1626.	1723.	909.	1790.	409.	370.2	.668	.570	4.176	267.2	.007	3.434	A14
04LD001	1921-82	62R	11900.0	926.	1193.	1359.	1512.	1703.	1843.	1981.	965.	1834.	426.	384.0	.713	.714	3.563	295.9	-.013	3.069	A11
04LF001	1919-82	54R	6760.0	505.	636.	713.	790.	860.	916.	970.	516.	969.	214.	362.4	.684	.507	3.712	149.2	.003	3.329	A14

TOTAL NUMBER OF STATIONS: 13 NATURAL: 11 REGULATED: 2

* - DENOTES STATION HAVING MINOR REGULATION (CLASSIFIED AS NATURAL FOR CALCULATIONS)

TABLE : A.13.6

DATA FOR STATIONS IN REGION 11

STATION NUMBER	DATA YEARS	TOT	AREA SQ.KM.	PREDICTED DISCHARGES (CMS) Q2	Q5	Q10	Q20	Q50	Q100	Q200	RECORDED MEAN	QMAX	QMIN	MAR MM.	DISTRIBUTION PARAMETERS BFI	CS	CK	SD	CSL	CKL	POR
02AA001	1924-82	59N	1550.0	134.	188.	223.	256.	299.	331.	363.	143.	311.	45.	292.3	.682	.831	3.502	59.5	-.019	3.049	A11
02AB008	1954-82	29N	187.0	29.	45.	57.	70.	88.	102.	117.	32.	75.	8.	294.1	.406	1.132	4.074	18.6	-.064	3.180	A22
02AB014	1972-83	12N	112.0	19.	29.	37.	46.	59.	70.	82.	22.	45.	11.	353.6	.377	1.069	5.818	9.6	-.308	3.162	A62
02AB016	1972-82*	11N	145.0	24.	40.	52.	65.	84.	99.	115.	28.	72.	11.	307.6	.361	1.410	6.002	18.8	-.426	3.345	C74
04CA003	1968-80	13N	619.0	31.	41.	47.	53.	61.	68.	74.	33.	56.	19.	294.0	.646	1.107	4.979	10.3	-.005	4.482	A17
04CB001	1968-80	13N	10800.0	216.	269.	300.	327.	360.	383.	405.	227.	340.	136.	325.0	.978	.501	5.151	56.8	-.023	4.958	B18
04CE002	1968-82	15N	4350.0	64.	82.	92.	100.	111.	118.	125.	66.	104.	33.	287.4	.979	.491	3.905	26.5	.189	2.704	C44
04DA001	1967-80	14N	5960.0	234.	338.	423.	516.	656.	774.	905.	265.	499.	144.	337.2	.846	.970	4.512	102.1	-.272	3.068	A51
04DA002	1968-77	10N	19000.0	496.	658.	760.	856.	977.	1066.	1155.	520.	835.	261.	360.0	.996	.583	4.005	175.1	-.057	4.340	A27
04DB001	1967-80	14N	7950.0	276.	377.	443.	506.	588.	650.	713.	293.	450.	132.	328.3	.937	0.000	3.178	96.9	-.738	4.015	C87
04DB002	1968-77	10N	3240.0	130.	175.	205.	233.	268.	295.	322.	137.	214.	68.	345.7	.633	.448	3.403	48.4	-.105	3.793	A36
04FA001	1970-82*	13N	9010.0	277.	398.	489.	585.	721.	830.	946.	308.	612.	165.	340.7	.858	1.090	5.989	122.8	-.242	3.147	A52
04FA003	1967-82	16N	4900.0	245.	303.	338.	369.	408.	435.	461.	251.	354.	162.	389.8	.765	.188	2.585	63.9	-.090	2.560	A24
04FB001	1966-82	17N	24200.0	879.	1134.	1278.	1405.	1555.	1660.	1760.	920.	1440.	453.	363.2	.874	.231	3.290	277.8	-.042	3.407	B24
04GA002	1971-83	13N	5390.0	69.	108.	141.	184.	250.	310.	380.	64.	225.	42.	263.5	.990	2.336	.114	48.4	-.092	4.496	A39
04GB004	1972-83	12N	11200.0	208.	303.	381.	467.	597.	708.	832.	241.	614.	124.	267.9	.858	2.563	1.501	128.0	.154	5.869	A49
04JF001	1969-83	15N	5360.0	166.	235.	286.	339.	415.	475.	540.	185.	388.	94.	307.8	.855	1.541	6.212	77.7	-.020	4.255	A17
05PA006	1923-82	60N	13400.0	308.	425.	495.	558.	635.	690.	743.	324.	800.	91.	255.2	.987	.712	4.968	130.9	-.015	3.211	B13
05PB014	1921-82	62N	4870.0	118.	172.	207.	241.	285.	319.	352.	128.	305.	40.	238.2	.922	.717	3.569	57.6	-.093	2.511	A34
05PC010	1952-83	32N	168.0	20.	31.	38.	45.	55.	62.	70.	23.	59.	4.	200.0	.695	1.364	6.184	11.5	-.041	3.483	B24
05PC011	1952-82	31N	461.0	31.	55.	75.	98.	134.	165.	200.	39.	111.	12.	196.1	.700	1.084	5.100	22.6	-.341	2.339	A65
05PC016	1960-82	23N	243.0	30.	43.	54.	60.	71.	79.	88.	32.	72.	12.	232.5	.750	.872	4.940	13.9	-.109	2.886	A32
05PC022	1971-82	12N	.7	.13	.20	.27	.33	.43	.52	.61	.15	.31	.06	157.1	.400	1.043	4.239	.10	-.184	3.716	A46
05QA001	1922-81	60N	13900.0	262.	392.	482.	571.	692.	785.	881.	291.	719.	86.	273.4	.992	1.048	4.078	141.8	-.056	2.889	A22
05QA002	1922-82	61N	6230.0	141.	218.	272.	328.	403.	462.	524.	160.	449.	37.	287.3	.982	1.215	4.668	84.7	-.036	3.003	A11
05QA004	1963-82	21N	4453.0	97.	149.	190.	234.	298.	353.	412.	113.	226.	47.	283.1	.969	.832	3.137	52.5	-.177	2.881	A42
05QC003	1970-82	13N	2370.0	43.	60.	73.	86.	106.	122.	139.	49.	104.	27.	223.6	.920	2.003	.285	20.3	.045	6.068	B29
05QE008	1970-82	13N	1690.0	20.	35.	47.	61.	81.	98.	117.	25.	71.	7.	209.5	.968	1.806	7.437	17.3	-.013	4.486	A17
05QE009	1965-82	18N	1530.0	38.	56.	70.	88.	116.	140.	166.	44.	98.	25.	222.9	.901	1.702	7.268	18.3	-.266	3.149	A52
05PA012	1930-82	53R	4510.0	155.	212.	248.	281.	322.	353.	383.	165.	442.	52.	274.9	.869	1.488	8.603	65.1	.055	4.174	B27

TOTAL NUMBER OF STATIONS: 31 NATURAL: 30 REGULATED: 1

DATA FOR STATIONS IN REGION 12

STATION NUMBER	DATA YEARS	TOT	AREA SQ.KM.	PREDICTED DISCHARGES (CMS) Q2	Q5	Q10	Q20	Q50	Q100	Q200	RECORDED MEAN	QMAX	QMIN	MAR MM.	DISTRIBUTION PARAMETERS BFI	CS	CK	SD	CSL	CKL	POR
04CD001	1967-77	11N	21100.0	582.	897.	1175.	1495.	1995.	2436.	2941.	582.	1192.	348.	216.6	.809	.799	3.655	296.7	-.359	3.375	A64
04DC001	1966-81	16N	50000.0	1521.	2084.	2094.	2280.	2504.	2663.	2815.	1586.	2302.	689.	300.0	.937	.441	4.152	393.8	-.024	4.207	B17
04DC002	1968-82	15N	4710.0	408.	399.	451.	497.	551.	588.	624.	315.	630.	136.	286.7	.609	.283	3.591	103.0	-.030	3.441	A14
04EA001	1958-82	25N	10400.0	731.	1013.	1201.	1382.	1619.	1798.	1981.	780.	1180.	329.	296.1	.595	-.128	2.607	268.5	-.689	3.420	C84
04FC001	1969-82	14N	36000.0	1344.	1986.	2589.	3627.	5312.	6991.	9102.	1616.	3234.	1012.	336.9	.875	1.474	5.654	649.6	-.386	3.407	A64
04KA001	1973-82	10N	4250.0	401.	620.	794.	982.	1267.	1489.	1742.	485.	821.	246.	277.6	.561	.553	4.998	204.9	-.356	4.387	B67
04LM001	1973-82	10N	22900.0	2244.	2581.	2729.	2840.	2955.	3026.	3087.	2264.	2857.	1590.	338.9	.535	-.323	5.204	402.0	-.064	5.274	B29
04MF001	1967-82	16N	6680.0	773.	913.	964.	999.	1030.	1048.	1062.	744.	1007.	307.	428.6	.612	-.551	3.980	199.5	-.214	3.018	B51
04LG002	1963-82	20R	50100.0	5256.	6295.	5991.	7664.	8550.	9226.	9914.	5524.	8330.	3880.	409.3	.693	.862	4.633	1106.0	-.068	3.583	B25

TOTAL NUMBER OF STATIONS: 9 NATURAL: 8 REGULATED: 1

* - DENOTES STATION HAVING MINOR REGULATION (CLASSIFIED AS NATURAL FOR CALCULATIONS)

TABLE # A.13.7

STATIONS HAVING 5-9 YEARS OF DATA OR FAILING NONPARAMETRIC TESTS

DATA FOR REGION 1

STATION NUMBER	DATA YEARS	TOT	AREA (SQ.KM)	MEAN (CMS)	MAR (MM)	BFI	STATION NUMBER	DATA YEARS	TOT	AREA (SQ.KM)	MEAN (CMS)	MAR (MM)	BFI
02CDC03	1978-82	5R	319.0	22.0	499.8	.691	02CD004	1978-82	5R	567.0	36.0	544.3	.835
02CDC05	1978-83	6N	99.5	13.0	565.8	.611	02CD006	1978-82	5N	157.0	14.0	575.1	.701
02CF008	1975-82	8N	155.0	26.0	371.1	.562	02CF010	1976-82	7N	697.0	88.0	544.0	.625
02CF012	1977-83	7N	207.0	22.0	496.7	.565	02DB004	1942-50	9N	64.8	24.0	554.0	.367
02DB006	1974-80	6R	2750.0	119.0	367.1	.777	02DD013	1974-83	10N	70.4	14.8	443.2	.361
02DD014	1975-82	8N	37.3	10.0	529.6	.443	02DD015	1975-82	8N	106.0	18.0	536.7	.525
02EA012	1974-78	5N	235.0	35.0	500.2	.502	02EB013	1974-83	10N	593.0	105.0	591.9	.593
02HE003	1970-77	8N	29.3	7.0	435.1	.422	02HF004	1976-82	7N	21.8	6.0	338.1	.321
02HL102	1969-75	7N	160.0	25.0	550.0	.497	02HL103	1969-77	9N	199.0	24.0	496.9	.614
02HM201	1969-75	7N	21.0	5.6	239.6	.370E	02JE014	1963-71	9N	2040.0	156.0	395.5	.687
02KA009	1972-82	11N	.11	.03	322.4	.400							

DATA FOR REGION 2

02LB013	1976-83	8R	2410.0	679.0	198.0	.282	02LB016	1978-83	6N	76.1	49.0	392.8	.275
02LB017	1978-83	6N	69.2	14.0	421.2	.375	02LB022	1977-83	7N	152.0	60.0	398.6	.255

DATA FOR REGION 3

02ED101	1969-78	10N	334.0	34.0	294.9	.590	02FC014	1972-77	6R	381.0	87.0	487.5	.428
02FC016	1976-82	7N	329.0	80.0	459.4	.474							

DATA FOR REGION 4

02GA002	1914-22	9N	1420.0	314.0	301.4	.299	02GA008	1914-22	9R	707.0	108.0	285.2	.505
02GD006	1938-54	17N	554.0	97.0	398.1	.423	02GD013	1974-83	10N	38.9	29.0	415.9	.273

DATA FOR REGION 5

02GE007	1978-82	5N	202.0	87.0	338.8	.187	02GH003	1977-83	7N	159.0	46.8	308.8	.159

DATA FOR REGION 6

02GC021	1967-82	16R	68.40	7.00	496.7	.801	02GC023	1970-76	7R	5.20	.93	863.0	.913
02GC025	1970-75	6R	10.1	1.1	396.0	.615	02GC026	1976-83	8R	676.0	108.0	470.0	.528
02GC202	1968-76	9N	18.70	2.39	155.20	.000	02GC203	1968-76	7N	5.96	21.70	279.4	E.790E

DATA FOR REGION 7

02MA014	1978-82	5N	60.9	34.0	347.0	.255	02MB016	1978-82	5R	124.0	12.0	379.4	.68E
02MA201	1967-75	9R	40.9	9.9	225.9	-							

DATA FOR REGION 8

02MC011	1957-61	5N	495.0	45.0	201.5	.616	02MC015	1958-62	5N	223.0	41.0	189.2	.532
02MC038	1975-82	8R	52.0	14.0	379.9	.573	02MC039	1975-82	8R	38.3	10.0	322.4	.492
02MC045	1975-82	8N	25.9	12.0	243.0	.383	02MC046	1974-82	9N	10.6	6.0	429.1	.557
02MD012	1977-83	7N	232.0	82.0	449.0	.655	02MD212	1966-72	7N	20.5	7.9	245.7	.600E
02MD213	1966-72	7R	10.4	7.9	530.9	.580E	02MD222	1967-77	11N	15.8	9.6	271.2	.690E
02MD231	1967-77	11N	10.9	1.2	231.3	.620E	02MD234	1970-77	8N	17.6	10.0	232.2	.560E

DATA FOR REGION 9

02EC008	1965-69	5R	311.0	29.0	213.0	.412	02ED011	1974-82	9N	168.0	32.0	359.8	.515

DATA FOR REGION 10

02BC002	1953-60	8R	2400.0	168.0	315.4	.795	02BE001	1930-35	6N	2850.0	235.0	457.1	.780
02BF003	1971-77	7N	18.6	6.0	657.5	.359	02JC009	1968-77	10N	251.0	19.0	371.6	.777
04MD004	1977-82	6N	401.0	56.0	436.4	.488							

DATA FOR REGION 11

02AA002	1973-78	6N	389.0	107.0	39.3	.258	02AC001	1971-82	12N	736.0	76.0	299.8	.678
02AD010	1972-81	10N	650.0	51.0	334.4	.582	02AE001	1975-82	8N	616.0	75.0	382.4	.598
04CB005	1977-82	6N	1170.00	23.00	225.6	.894	05PD025	1972-82	8N	.90	.15	174.4	.400E

DATA FOR REGION 12

04CC001	1970-79	10N	94300.0	2122.0	238.6	.891

TABLE A13.8

DATA FOR SELECTED STATIONS - ALL REGIONS

STATION NUMBER	DATA YEARS	TOT	AREA SQ.KM.	PREDICTED DISCHARGES (CMS) Q2	Q5	Q10	Q20	Q50	Q100	Q200	RECORDED MEAN	QMAX	QMIN	MAR PM.	BFI	DISTRIBUTION PARAMETERS CS	CK	SD	CS3	CK3	PDK
02AA001	1924-82	59N	1550.0	134.	188.	223.	256.	299.	331.	363.	143.	311.	45.	292.3	.682	-.831	3.502	59.5	-.019	3.049	A11
02AB008	1954-82	29N	187.0	28.	45.	57.	70.	88.	102.	117.	32.	75.	8.	294.1	.406	1.132	4.074	18.6	-.064	3.180	A22
02AB014	1972-83	12N	112.0	19.	29.	37.	46.	59.	70.	82.	22.	45.	11.	353.6	.377	1.069	5.818	9.6	-.308	3.162	A62
02BA002	1970-82	13N	1190.0	79.	95.	101.	107.	112.	115.	118.	79.	109.	40.	396.6	.840	-.453	4.742	19.4	-.051	4.408	B27
02BB002	1960-82	15N	1980.0	206.	244.	264.	281.	300.	312.	324.	210.	302.	122.	449.0	.624	.510	3.716	69.0	-.121	3.762	A36
02BB003	1970-82	13N	4270.0	437.	559.	629.	692.	767.	820.	871.	461.	759.	239.	367.7	.640	.078	5.415	43.6	.002	5.398	B19
02BF001	1960-83	16N	1190.0	187.	277.	365.	474.	655.	825.	1029.	219.	460.	130.	598.3	.662	.721	6.664	132.7	.220	6.114	B19
02BF002	1960-82	15N	1160.0	203.	276.	325.	373.	436.	484.	533.	217.	370.	114.	516.4	.529	1.498	7.196	84.1	-.460	2.860	A72
02CA002	1971-83	13N	188.0	30.	43.	54.	67.	87.	105.	125.	34.	58.	20.	563.2	.573	.574	3.399	76.7	-.134	3.037	A31
02CD001	1967-82	16N	1350.0	101.	124.	138.	150.	165.	175.	184.	103.	152.	59.	352.	.852	.834	3.917	12.5	-.347	3.096	A62
02CE007	1962-82	21N	272.0	39.	48.	54.	60.	66.	71.	76.	40.	60.	24.	508.1	.811	.301	3.259	26.5	-.036	3.301	A14
02CF009	1959-82*	24N	21.5	10.	13.	15.	18.	21.	23.	26.	11.	20.	7.	355.9	.548	-.108	2.888	9.8	-.515	2.696	C74
02CF011	1971-82	12N	704.0	57.	80.	99.	119.	149.	174.	201.	65.	149.	35.	474.4	.268	1.098	4.548	3.3	-.112	3.071	A31
02DD008	1957-82	26N	90.4	20.	27.	32.	37.	43.	48.	53.	21.	50.	9.	456.0	.625	2.292	9.982	30.1	.162	5.813	A49
02EA005	1916-82	67N	321.0	43.	56.	64.	72.	81.	88.	95.	45.	96.	22.	576.3	.414	1.662	7.622	8.5	.063	4.216	A27
02EA006	1916-82*	67N	650.0	48.	64.	75.	86.	99.	110.	120.	51.	109.	23.	551.4	.664	.855	4.493	14.5	-.017	3.103	A12
02EA008	1946-57	12N	1850.0	128.	159.	118.	195.	215.	230.	245.	135.	199.	99.	523.4	.758	.811	3.702	17.5	-.071	2.662	A24
02EA010	1968-82	15N	149.0	29.	39.	48.	60.	78.	95.	115.	33.	52.	23.	490.3	.698	.570	5.436	33.3	-.039	5.103	B19
02EC002	1916-82	67N	1520.0	130.	156.	171.	184.	198.	209.	218.	132.	229.	60.	625.5	.502	.998	4.028	9.6	-.426	2.953	A71
02EC009	1966-82	17N	181.0	32.	47.	57.	67.	81.	92.	103.	36.	88.	14.	454.6	.693	.372	4.162	30.5	.314	3.816	B16
02EC010	1967-82	16N	42.9	18.	13.	15.	16.	18.	20.	21.	10.	15.	6.	240.3	.468	1.896	9.263	16.7	.020	4.466	A17
02EC011	1967-82	16N	282.0	54.	65.	72.	78.	86.	92.	98.	56.	75.	39.	222.8	.346	-.027	2.418	2.9	-.369	2.537	C64
02EC101	1971-82*	12N	24.3	3.11	4.94	6.28	7.66	9.58	11.11	12.74	3.56	8.51	1.25	322.7	.455	.322	2.831	11.4	-.113	3.189	B32
02EC103	1978-82	13N	332.0	42.	61.	74.	87.	105.	118.	132.	46.	70.	20.	469.1	.824	1.404	7.151	2.0	-.137	3.947	A36
02ED003	1949-82	34N	1180.0	121.	181.	223.	266.	325.	372.	421.	136.	370.	42.	307.2	.503	-.157	2.726	17.7	-.669	3.057	C81
02ED004	1964-78*	15N	207.0	24.	38.	49.	59.	73.	84.	95.	29.	67.	9.	255.1	.550	1.718	6.851	69.8	.064	3.876	A26
02ED005	1964-82*	19N	295.0	54.	78.	94.	110.	132.	149.	166.	59.	129.	24.	199.3	.489	1.186	6.443	15.1	-.081	4.284	B27
02ED007	1966-82	17N	177.0	32.	41.	46.	51.	57.	62.	66.	33.	57.	17.	423.7	.608	1.213	5.138	26.5	-.112	3.892	A16
02ED009	1973-83	11N	95.0	27.	33.	36.	39.	42.	44.	46.	27.	40.	16.	407.9	.632	.877	4.745	9.7	.021	4.366	A17
02ED010	1973-82	10N	127.0	15.	17.	19.	20.	21.	23.	23.	15.	20.	10.	294.7	.329	.199	4.349	6.7	-.112	4.304	A17
02ED102	1969-82	14N	211.0	44.	78.	89.	109.	136.	158.	181.	51.	122.	23.	302.4	.488	.180	4.049	3.1	-.027	4.002	A17
02ED103	1969-82	14N	195.0	22.	33.	43.	54.	70.	84.	99.	35.	53.	12.	304.7	.531	1.246	4.344	31.2	.627	3.052	C81
02FA001	1958-82	25N	927.0	122.	162.	188.	213.	244.	267.	291.	128.	203.	60.	379.5	.710	1.113	4.771	11.7	-.246	3.272	A53
02FB007	1946-82	37N	181.0	36.	52.	63.	74.	88.	98.	109.	39.	99.	11.	462.8	.615	-.026	2.495	39.6	-.587	3.021	C71
02FB010	1958-82*	25N	293.0	65.	95.	120.	149.	192.	228.	270.	76.	132.	39.	503.3	.564	1.204	5.404	18.3	-.003	3.418	A14
02FC001	1916-82	67N	3960.0	561.	757.	878.	991.	1131.	1233.	1334.	569.	1162.	197.	481.2	.546	.587	2.598	29.1	-.279	2.621	B54
02FC002	1916-82	67N	2150.0	311.	435.	522.	609.	726.	817.	912.	340.	774.	137.	449.5	.643	.652	3.228	216.1	-.024	2.932	A11
02FC004	1916-40	26N	249.0	10.	24.	28.	32.	38.	42.	46.	19.	49.	4.	443.3	.623	1.306	4.866	140.2	.000	3.227	A13
02FC011	1954-82	29N	163.0	32.	48.	58.	69.	82.	93.	103.	36.	82.	10.	445.8	.813	2.268	1.721	8.0	.236	6.307	B59
02FC015	1972-82	11N	663.0	100.	124.	139.	153.	171.	183.	196.	103.	142.	70.	404.3	.509	1.202	4.497	17.4	.036	3.803	A16
02FD001	1974-83	10N	154.0	87.	130.	158.	185.	220.	247.	275.	100.	196.	39.	512.8	.619	.247	2.486	26.7	.058	2.331	C25
02FE002	1953-82*	30N	1630.0	394.	561.	664.	758.	875.	961.	1044.	416.	776.	142.	431.8	.236	1.073	8.239	45.5	-.040	6.712	B19
02FE004	1946-62*	37N	1760.0	438.	640.	770.	893.	1051.	1168.	1286.	473.	1119.	123.	420.9	.407	.274	2.405	180.4	-.096	2.314	A35
02FE008	1971-82	12N	648.0	182.	240.	275.	307.	347.	375.	402.	189.	306.	90.	436.4	.457	.793	3.944	220.2	.048	2.987	A21
02FE009	1971-82	12N	376.0	103.	147.	184.	224.	284.	335.	391.	116.	181.	63.	432.1	.334	.326	3.348	63.7	-.079	3.351	A24
02FE010	1968-79	12N	197.0	55.	77.	93.	109.	130.	147.	164.	60.	109.	30.	484.0	.315	.502	2.594	42.9	-.269	3.166	A52
02FF002	1944-82	35N	865.0	207.	291.	347.	401.	473.	527.	582.	226.	423.	99.	388.6	.238	.858	4.363	23.3	-.128	3.681	A35
02FF003	1954-67	14N	124.0	55.	103.	141.	182.	243.	295.	351.	69.	156.	15.	358.4	.365	.669	3.072	89.3	-.084	2.865	B22
02FF004	1966-82	17N	41.4	24.	31.	36.	39.	44.	47.	50.	25.	42.	12.	290.3	.197	.672	3.295	45.4	-.290	2.904	A52
02FF006	1957-69	13N	33.7	10.00	20.00	27.00	34.00	46.00	55.00	65.00	13.00	28.00	2.00	364.7	.185	.418	3.626	7.8	-.034	3.423	A14
02FF007	1967-82	16N	466.0	174.	228.	263.	296.	339.	371.	403.	183.	311.	101.	365.0	.190	.530	2.735	8.70	-.249	3.046	A51
02FF008	1973-82	10N	110.0	34.	40.	43.	45.	49.	51.	53.	34.	45.	27.	337.0	.332	.910	4.665	59.4	-.037	3.840	A16
02GA001	1913-23	11N	760.0	192.	275.	327.	375.	436.	482.	527.	215.	338.	99.	427.3	.172	.356	3.068	6.3	.232	2.919	A51
02GA003	1914-79	66N	3520.0	713.	1015.	1212.	1398.	1637.	1815.	1994.	766.	1662.	204.	321.1	.293	.261	3.960	84.2	-.146	3.895	B46
02GA010	1948-82	35N	1030.0	247.	329.	377.	420.	471.	507.	542.	259.	428.	92.	312.5	.493	.763	3.489	330.2	-.048	2.793	A23
02GA015	1951-79	29N	593.0	69.	107.	133.	159.	194.	221.	249.	78.	166.	18.	334.0	.488	.299	2.662	30.0	-.044	2.763	B23
02GA016	1948-79	32N	800.0	245.	364.	444.	521.	623.	701.	780.	269.	731.	91.	303.5	.545	.796	3.191	40.2	-.076	2.949	A21
02GA017	1951-72	22N	324.0	150.	195.	218.	237.	259.	274.	287.	153.	260.	47.	338.8	.527	1.366	6.846	131.4	-.058	3.200	A23
02GA018	1951-82	32N	552.0	210.	298.	353.	403.	466.	511.	557.	223.	453.	76.	342.4	.299	.449	2.939	35.8	-.071	2.640	A24
02GA030	1966-82*	17N	49.7	10.00	15.00	19.00	24.00	30.00	34.00	39.00	11.00	22.00	3.00	136.4	.364	.675	3.000	5.90	-.150	3.012	A41
02GA031	1969-82*	14N	44.5	5.00	7.00	8.00	9.00	11.00	11.00	12.00	5.00	9.00	2.00	418.0	.732	.133	2.854	2.20	-.052	2.781	A23
02GA032	1978-82	13N	2.5	2.20	4.62	6.81	9.37	13.42	17.05	21.25	3.00	8.92	.33	296.0	.222	1.404	6.206	2.40	-.574	4.383	C77
02GA035	1971-83	13N	27.7	15.	21.	25.	30.	35.	40.	44.	16.	27.	7.	371.6	.432	.269	2.757	6.7	-.188	2.694	A44
02GA036	1971-83	13N	17.9	15.	22.	26.	30.	35.	39.	42.	16.	28.	5.	413.4	.196	.184	2.569	7.4	-.123	2.678	A34
02GA037	1972-83	12N	25.1	16.	25.	32.	39.	50.	59.	68.	18.	41.	7.	446.2	.317	1.270	6.151	9.4	-.179	3.712	A46
02GA038	1972-82	11N	326.0	204.	268.	309.	347.	397.	433.	470.	213.	289.	135.	349.7	.187	-.253	2.191	64.2	-.382	2.213	C66

TABLE A14.1 (SHEET 1 OF 6)

STATION NUMBER	DATA YEARS	TOT	AREA SQ.KM.	PREDICTED DISCHARGES (CMS) Q2	Q5	Q10	Q20	Q50	Q100	Q200	RECORDED MEAN	QMAX	QMIN	MAP MM.	BFI	CS	DISTRIBUTION PARAMETERS CK	SD	CS3	CK3	POR
02GA039	1973-82	10N	272.0	207.	291.	347.	402.	474.	529.	585.	223.	388.	125.	419.1	.197	.554	3.737	88.8	.047	2.946	C21
02GA040	1974-83*	10N	167.0	60.	89.	108.	128.	153.	173.	193.	65.	114.	28.	397.6	.390	.356	3.394	29.3	-.204	3.151	A52
02GB001	1948-79	32N	5210.0	928.	1337.	1588.	1817.	2103.	2310.	2513.	982.	1833.	264.	332.1	.550	.357	2.557	444.2	-.076	2.514	A24
02GB002	1914-23*	10N	5910.0	815.	976.	1079.	1177.	1302.	1396.	1490.	862.	1284.	615.	318.1	.473	1.628	1.600	180.0	.112	9.453	B39
02GB006	1954-82*	29N	150.0	35.	49.	58.	67.	79.	88.	98.	38.	78.	16.	378.7	.484	1.116	4.775	15.1	-.016	3.617	B15
02GB007	1965-82	18N	360.0	50.	63.	71.	77.	85.	90.	95.	50.	77.	22.	308.3	.419	.137	2.824	15.7	-.027	2.897	A12
02GB008	1962-82*	21N	383.0	56.	71.	80.	87.	95.	101.	106.	57.	92.	24.	344.6	.546	.155	3.395	17.6	-.015	3.422	B14
02GB009	1962-82	21N	91.9	36.	55.	69.	83.	102.	118.	134.	40.	89.	14.	353.6	.328	.903	3.773	20.1	-.122	3.043	A31
02GB011	1964-76	13N	29.0	4.00	10.00	15.00	21.00	32.00	42.00	54.00	6.00	19.00	1.00	271.4	.694	1.335	4.697	5.60	-.246	3.697	A56
02GC004	1955-75*	21N	697.0	65.	104.	132.	162.	203.	236.	271.	75.	210.	17.	348.6	.601	1.784	6.478	47.4	.125	4.647	A38
02GC007	1956-82*	27N	591.0	40.	72.	99.	129.	177.	219.	266.	53.	252.	13.	335.0	.753	3.100	4.785	48.0	.208	4.584	A58
02GC011	1964-78*	15N	142.0	30.	46.	56.	67.	80.	91.	102.	34.	62.	12.	331.2	.529	.396	2.972	15.9	-.155	3.291	B44
02GC012	1964-82*	19N	51.3	5.00	7.00	9.00	10.00	13.00	14.00	16.00	5.00	14.00	2.00	419.1	.801	1.325	3.586	2.70	-.047	4.019	C27
02GC015	1964-82*	19N	104.0	12.	17.	21.	24.	29.	33.	37.	13.	26.	6.	438.5	.672	.738	3.668	5.3	-.126	2.961	A31
02GC016	1965-77*	13N	109.0	15.	25.	33.	42.	56.	67.	80.	18.	37.	6.	409.2	.589	.692	3.341	9.6	-.264	3.122	A52
02GC018	1965-82	18N	287.0	113.	143.	162.	180.	201.	217.	233.	117.	151.	59.	393.7	.277	-.649	2.728	28.9	-.935	3.640	C95
02GD001	1916-56	51N	1340.0	200.	314.	392.	470.	574.	654.	737.	226.	813.	39.	335.8	.567	1.350	3.539	134.0	-.050	3.801	A26
02GD003	1916-44	29N	1450.0	364.	487.	556.	616.	687.	735.	792.	379.	718.	114.	354.2	.385	.297	3.526	137.4	-.021	3.194	B13
02GD009	1946-64	19N	140.0	45.	73.	95.	119.	154.	183.	214.	55.	109.	20.	419.3	.533	.886	3.774	28.4	-.218	3.183	B52
02GD010	1946-82	37N	150.0	56.	84.	102.	121.	145.	164.	183.	63.	150.	8.	384.0	.353	1.304	5.062	30.8	.032	3.801	916
02GD012	1952-64	13N	254.0	49.	94.	134.	179.	248.	309.	379.	64.	169.	14.	347.2	.411	1.340	5.093	47.5	-.214	3.664	A55
02GD019	1967-82	16N	36.0	19.	24.	29.	34.	43.	52.	62.	21.	44.	16.	477.8	.276	3.038	4.399	6.7	-.140	4.153	A37
02GD020	1966-82	17N	108.0	36.	50.	59.	67.	77.	85.	93.	38.	70.	15.	314.8	.358	.760	3.991	14.9	-.035	3.067	A15
02GE005	1966-82	17N	146.0	35.	47.	56.	64.	74.	82.	90.	37.	69.	18.	316.4	.294	1.053	5.046	13.7	-.040	3.805	A16
02GG002	1949-82	34N	730.0	113.	154.	179.	204.	235.	258.	281.	121.	238.	43.	320.5	.416	1.115	4.870	45.4	-.052	4.133	B27
02GG004	1965-82	18N	609.0	94.	138.	170.	203.	248.	284.	322.	105.	225.	49.	287.4	.265	1.004	5.030	45.7	-.178	2.942	A41
02GG005	1967-82	16N	172.0	33.	46.	57.	69.	87.	102.	118.	38.	99.	21.	355.8	.468	2.739	2.343	18.4	.170	5.342	A49
02GG006	1967-82	16N	267.0	86.	131.	163.	194.	236.	269.	303.	96.	226.	35.	298.9	.202	1.233	5.943	48.8	-.080	3.682	A25
02GG007	1967-82	16N	1240.0	144.	188.	223.	259.	312.	356.	404.	158.	326.	98.	312.1	.365	2.157	8.480	57.2	.193	5.326	A59
02GH001	1972-83	12N	14.2	.16	.29	.41	.55	.77	.97	1.21	.22	.50	.03	412.7	.390	1.141	5.786	.10	-.324	4.371	d67
02GH002	1972-83	12N	125.0	55.	76.	89.	103.	120.	132.	145.	58.	102.	27.	206.4	.151	.757	4.178	22.5	-.066	3.985	A26
02HA003	1926-51	26N	686000.0	6737.	7427.	7916.	8152.	8547.	8821.	9081.	6779.	8514.	5192.	271.8	.995	-.186	3.523	766.8	-.499	3.516	C75
02HA006	1957-82	26N	293.0	73.	100.	116.	131.	148.	161.	174.	76.	143.	25.	301.7	.151	.556	3.650	29.7	-.025	3.281	A13
02HB002	1946-82*	37N	795.0	150.	245.	316.	390.	494.	579.	669.	178.	616.	32.	315.7	.574	2.121	8.341	126.4	.153	4.264	A47
02HB008	1963-82*	20N	127.0	16.	23.	27.	30.	34.	37.	40.	17.	33.	6.	323.6	.566	.364	3.342	7.1	-.057	2.909	A22
02HB010	1961-78	10N	166.0	21.	29.	33.	38.	43.	47.	50.	22.	34.	9.	345.2	.515	.195	2.960	8.5	-.097	3.279	A33
02HB012	1973-82	11N	82.6	25.	34.	38.	42.	47.	50.	54.	26.	45.	11.	348.7	.451	.373	4.931	9.3	-.015	4.517	A18
02HB204	1967-77	11N	30.	18.0	43.0	67.0	95.	143.	87.0	239.0	29.	136.0	2.00	160.0	.260	2.857	3.000	36.90	.040	5.657	A19
02HC002	1946-61	16N	166.0	144.	201.	230.	253.	279.	296.	311.	148.	252.	22.	240.4	.191	-.036	2.999	66.4	-.015	2.995	B11
02HC003	1952-82*	31N	800.0	126.	220.	295.	376.	494.	593.	701.	172.	1449.	25.	225.0	.450	5.171	1.294	242.5	.820	9.160	B89
02HC006	1949-77*	29N	249.0	76.	109.	127.	143.	163.	176.	189.	80.	151.	25.	348.6	.535	.198	2.729	35.8	-.051	2.562	B24
02HC009	1954-82	29N	197.0	27.	46.	61.	75.	96.	112.	130.	32.	121.	6.	185.3	.437	2.227	1.123	22.5	-.049	3.581	A25
02HC012	1957-81*	25N	169.0	20.	35.	47.	60.	79.	95.	112.	25.	85.	4.	271.0	.601	1.634	7.859	17.8	-.032	3.516	A15
02HC013	1958-80	17N	86.1	30.	54.	74.	95.	127.	154.	183.	39.	153.	7.	519.9	.425	2.548	1.688	33.9	.055	4.340	D27
02HC017	1967-82	16N	63.2	29.	39.	46.	53.	63.	71.	79.	32.	53.	19.	284.8	.261	.674	3.870	10.6	-.177	3.348	B44
02HC018	1966-82	17N	106.0	28.	37.	43.	48.	54.	58.	63.	29.	56.	12.	257.5	.457	.824	5.583	10.3	.001	4.209	A17
02HC019	1966-82	17N	93.5	34.	55.	70.	85.	106.	124.	142.	40.	113.	11.	402.1	.577	1.913	8.619	23.9	.026	4.420	A17
02HC023	1969-81	13N	62.2	15.	20.	23.	26.	29.	31.	34.	16.	26.	7.	242.8	.566	.456	5.014	5.7	-.021	4.937	B18
02HC025	1963-82	20N	303.0	34.	53.	67.	81.	100.	116.	132.	39.	116.	14.	254.5	.590	2.237	.595	22.3	.024	4.342	A17
02HC026	1964-82*	19N	98.1	26.	44.	57.	71.	92.	109.	127.	31.	78.	8.	340.5	.476	1.063	4.448	18.3	-.140	3.114	A32
02HC027	1973-82	10N	58.0	51.	68.	79.	91.	107.	120.	133.	55.	89.	33.	432.8	.331	.795	4.620	17.1	-.151	3.915	A46
02HC028	1964-82	19N	77.7	23.	28.	32.	34.	37.	39.	41.	23.	34.	11.	314.0	.340	.065	2.961	6.6	-.016	3.017	B11
02HC029	1955-82	28N	130.0	39.	60.	74.	88.	106.	121.	136.	43.	89.	13.	346.9	.434	.383	2.443	21.1	-.176	2.250	A46
02HC030	1967-82	16N	204.0	80.	113.	138.	165.	202.	233.	266.	89.	163.	46.	323.5	.238	1.056	4.120	34.8	-.123	3.421	A34
02HC031	1966-82	17N	148.0	39.	53.	63.	74.	88.	100.	113.	43.	80.	25.	208.8	.227	1.068	5.123	14.3	-.169	3.095	A42
02HC032	1966-82	17N	94.8	14.	18.	21.	23.	25.	27.	28.	15.	24.	7.	188.8	.438	.243	3.728	4.6	-.128	3.660	B15
02HC033	1966-82	17N	63.2	30.	41.	48.	55.	65.	72.	80.	32.	50.	16.	361.3	.254	.515	2.758	11.5	-.225	2.941	A31
02HD002	1954-75	22N	2620.0	55.	102.	143.	190.	262.	326.	398.	72.	238.	16.	404.6	.642	1.826	6.842	55.5	-.082	3.508	A25
02HD003	1968-82*	23N	67.3	17.	26.	34.	42.	54.	65.	76.	20.	56.	8.	527.5	.699	1.977	7.937	11.2	-.042	3.703	A26
02HD004	1968-82*	23N	42.7	13.10	26.54	38.05	51.08	71.31	88.32	107.9	17.86	61.20	1.69	358.3	.645	1.842	6.795	15.80	-.990	3.480	A34
02HD007	1960-82	23N	77.7	25.	45.	62.	80.	107.	130.	156.	33.	155.	6.	334.6	.545	3.322	6.714	30.0	.185	4.963	A48
02HD008	1960-82	23N	95.8	37.	64.	86.	109.	143.	172.	203.	47.	145.	4.	376.8	.574	1.683	7.513	31.0	-.053	3.749	B26
02HD009	1966-82	17N	82.6	18.	32.	45.	60.	83.	104.	128.	25.	115.	7.	359.6	.619	3.472	6.828	24.5	.233	5.666	A59
02HD010	1966-82	17N	64.8	16.	26.	35.	44.	58.	70.	83.	20.	75.	8.	407.4	.617	3.269	5.729	15.2	.170	5.561	A49
02HD211	1969-78	10N	6.2	1.92	2.87	3.58	4.32	5.37	6.23	7.15	2.32	5.09	.52	135.5	.590	2.252	2.493	1.10	1.319	8.148	899
02HD214	1967-78	12N	26.2	8.	14.	19.	25.	34.	42.	51.	10.	20.	4.	304.6	.580	.760	3.577	5.4	-.354	3.164	A62
02HD221	1968-77	10N	4.3	2.24	4.13	5.54	7.00	9.04	10.69	12.44	2.69	6.74	.37	255.1	.550	.881	5.337	1.90	-.227	3.617	A55
02HD223	1966-77	12N	17.4	5.92	9.38	12.85	17.19	24.55	31.53	39.92	7.73	18.15	1.25	285.1	.540	1.835	8.107	4.40	-.168	5.617	B39
02HD224	1968-77	10N	14.0	12.	18.	25.	33.	48.	62.	79.	15.	28.	3.	230.7	.560	1.331	6.371	6.9	-.333	5.967	B69
02HD232	1966-76	11N	27.2	3.83	7.10	10.04	13.47	18.86	23.70	29.26	4.89	11.04	1.46	273.5	.550	.832	4.153	3.00	-.374	3.333	A64
02HD233	1968-77	10N	21.0	7.10	11.40	14.91	18.77	24.52	29.41	34.83	8.83	18.41	1.71	162.9	.560	1.307	8.802	4.40	-.276	5.337	B59
02HE001	1970-82	13N	13.9	3.85	5.50	6.63	7.73	9.19	10.31	11.47	4.15	6.44	1.60	389.9	.491	-.027	2.633	1.60	-.638	3.622	C85
02HE002	1970-82*	13N	114.0	30.	39.	46.	52.	60.	66.	71.	31.	62.	20.	417.5	.323	1.436	6.278	12.0	.819	3.357	C86

TABLE A14.1 (SHEET 2 OF 6)

STATION NUMBER	DATA YEARS	TOT	AREA SQ.KM.	PREDICTED DISCHARGES (CMS) Q2	Q5	Q10	Q20	Q50	Q100	Q200	MEAN	RECORDED QMAX	QMIN	PAR MM.	BFI	CS	DISTRIBUTION PARAMETERS CK	SD	CS3	CK3	PDR
02MJ001	1963-82	20N	118.0	19.	27.	34.	41.	52.	62.	72.	21.	50.	11.	321.8	.401	1.763	6.355	9.9	.048	4.033	A27
02MJ003	1971-82*	12N	282.0	48.	57.	69.	81.	99.	112.	127.	44.	66.	23.	320.2	.623	.415	2.815	16.2	-.238	2.956	A51
02ML004	1965-82	18N	712.0	74.	95.	110.	124.	142.	156.	171.	78.	139.	45.	360.0	.672	1.146	5.172	23.4	-.023	3.863	A16
02ML005	1966-82	17N	308.0	35.	44.	49.	55.	62.	67.	72.	36.	53.	23.	373.4	.531	.299	2.602	9.2	-.140	2.540	A34
02MM004	1972-82	11N	112.0	27.	35.	41.	47.	55.	61.	67.	29.	52.	17.	407.1	.374	1.623	7.147	9.5	-.095	5.824	A39
02MN005	1973-82	10N	155.0	37.	49.	57.	66.	78.	87.	98.	40.	65.	24.	540.6	.494	1.190	4.984	12.8	-.015	5.054	A19
02MJ010	1973-82	10N	1780.0	185.	227.	253.	276.	306.	328.	349.	190.	268.	126.	390.4	.635	.268	3.386	44.8	-.115	3.307	A34
02ME010	1973-82	10N	62.9	6.00	9.00	11.00	13.00	16.00	18.00	21.00	7.00	14.00	3.00	335.5	.631	1.576	8.096	3.10	-.086	4.806	A28
02KA003	1967-82	16N	6.0	.44	.52	.57	.62	.67	.71	.75	.45	.60	.30	311.7	.508	-.231	2.909	.10	-.543	2.944	C71
02KA004	1973-82	10N	.9	.10	.16	.22	.29	.40	.50	.61	.12	.34	.05	244.4	.387	2.513	1.563	.10	-.107	5.275	A39
02KA005	1968-83	16N	3.4	.35	.43	.48	.52	.57	.61	.65	.36	.48	.23	264.7	.367	-.081	2.680	.10	-.424	2.885	C72
02KA006	1970-82	13N	.8	.08	.10	.12	.13	.15	.16	.18	.08	.14	.05	187.5	.404	.811	4.409	0.00	.141	3.540	C45
02KA007	1973-82	10N	.2	.05	.07	.09	.11	.15	.19	.23	.05	.09	.03	450.0	.378	.549	3.374	0.00	-.432	3.346	A74
02KC014	1969-82	14N	443.0	43.	58.	68.	78.	92.	103.	115.	46.	81.	28.	345.4	.610	.321	4.496	15.4	-.119	3.493	A35
02KF011	1972-83	12N	269.0	60.	73.	82.	89.	98.	105.	112.	62.	96.	40.	356.0	.325	.979	5.976	14.5	-.016	5.054	A19
02LA006	1970-82*	13N	409.0	65.	76.	82.	87.	94.	99.	104.	66.	82.	48.	413.2	.410	-.124	2.459	11.6	-.308	2.618	C64
02LA007	1970-83	14N	559.0	120.	134.	141.	145.	150.	152.	155.	120.	148.	55.	277.3	.380	-.691	5.020	18.6	-.030	4.718	B18
02LB005	1946-82*	37N	3810.0	880.	989.	1075.	1141.	1209.	1251.	1297.	784.	1269.	261.	349.1	.271	-.490	3.213	245.0	-.013	3.310	B14
02LB006	1948-82	35N	433.0	144.	197.	233.	268.	313.	348.	384.	157.	304.	75.	420.3	.301	.771	3.683	56.3	-.096	3.840	B32
02LB007	1948-82	35N	246.0	51.	72.	86.	98.	113.	124.	136.	54.	125.	18.	351.5	.386	.846	4.700	23.6	-.024	3.269	A13
02LB008	1949-82	27N	440.0	119.	181.	224.	266.	321.	364.	408.	135.	318.	37.	479.5	.301	1.347	4.150	72.1	-.018	3.171	D12
02LB009	1955-82*	28N	1850.0	204.	253.	276.	294.	314.	326.	337.	204.	302.	108.	498.1	.297	-.122	2.404	59.0	-.043	2.458	B25
02LB012	1978-83	14N	76.7	21.	28.	36.	46.	62.	78.	97.	24.	42.	16.	432.9	.256	1.203	5.869	7.3	-.375	3.814	B66
02MC001	1961-82	22N	404.0	92.	114.	126.	135.	145.	152.	158.	93.	146.	40.	403.5	.365	-.115	3.549	26.8	-.007	3.591	B15
04CA003	1968-80	13N	619.0	31.	41.	47.	53.	61.	68.	74.	33.	56.	19.	294.0	.646	1.107	4.979	10.3	-.005	4.482	A17
04CB001	1958-80	13N	10800.0	216.	269.	300.	327.	360.	383.	405.	227.	340.	136.	325.0	.978	.501	5.151	56.8	-.023	4.958	B18
04CD001	1967-77	11N	21100.0	502.	897.	1175.	1495.	1995.	2436.	2941.	682.	1192.	348.	216.6	.809	.799	3.655	296.7	-.359	3.375	A64
04CD002	1973-82	10N	4270.0	67.	92.	108.	123.	144.	159.	174.	71.	111.	41.	271.7	.975	.491	2.905	26.5	.189	2.704	C44
04CE002	1968-82	15N	4350.0	64.	82.	92.	100.	111.	118.	125.	66.	104.	33.	287.4	.979	.288	3.448	19.6	-.032	3.421	A14
04DA001	1957-80	14N	5960.0	234.	338.	423.	516.	656.	774.	905.	265.	499.	144.	337.2	.846	.970	4.512	102.1	-.272	3.068	A51
04DA002	1968-77	10N	19000.0	496.	658.	760.	856.	977.	1066.	1155.	520.	835.	261.	360.0	.996	.583	4.005	175.1	-.057	4.340	A27
04DB001	1967-80	14N	7958.0	276.	377.	443.	506.	588.	650.	713.	293.	450.	132.	328.3	.937	0.000	3.178	96.9	-.738	4.015	C87
04DB002	1968-77	10N	3240.0	138.	175.	205.	233.	268.	295.	322.	137.	214.	68.	345.7	.633	.448	3.403	48.4	-.105	3.793	A36
04DC001	1966-81	16N	58000.0	1521.	1884.	2094.	2280.	2504.	2663.	2815.	1586.	2302.	689.	360.0	.937	.441	4.152	393.8	-.024	4.207	B17
04DC002	1968-82	15N	4710.0	308.	399.	451.	497.	551.	588.	624.	315.	530.	136.	288.7	.609	.283	3.591	103.0	-.030	3.441	A14
04EA001	1968-82	15N	10400.0	731.	1013.	1201.	1382.	1619.	1798.	1981.	780.	1180.	329.	298.1	.595	-.128	2.607	268.5	-.089	3.428	C84
04FA001	1978-82*	13N	9810.0	277.	398.	489.	585.	721.	830.	948.	308.	612.	165.	340.7	.858	1.090	5.989	122.8	-.242	3.147	A52
04FA003	1967-82	16N	4900.0	245.	303.	338.	369.	408.	435.	461.	251.	354.	162.	389.8	.765	.188	2.585	63.9	-.090	2.560	A24
04FB001	1966-82	17N	24200.0	879.	1134.	1278.	1405.	1555.	1660.	1760.	920.	1440.	453.	363.2	.874	.237	3.290	277.8	-.042	3.407	B24
04FC001	1969-82	14N	36000.0	1344.	1986.	2689.	3627.	5312.	6991.	9102.	1616.	3234.	1012.	338.9	.875	1.474	5.654	649.6	-.386	3.407	A64
04EA002	1971-83	13N	5390.0	69.	108.	143.	184.	250.	310.	380.	84.	225.	42.	263.5	.990	2.336	.114	40.4	-.092	4.496	A39
04GB004	1972-83	12N	11200.0	208.	303.	381.	467.	597.	708.	832.	241.	614.	124.	267.9	.858	2.563	1.501	128.0	-.154	5.869	A49
04JA002	1951-82	32N	3780.0	226.	270.	297.	321.	352.	375.	397.	234.	341.	156.	402.1	.856	.428	3.005	47.1	-.074	2.722	B23
04JC002	1951-82	32N	2410.0	119.	149.	168.	186.	209.	226.	242.	123.	199.	68.	316.6	.813	.483	2.687	33.1	-.064	2.750	A23
04JC003	1951-82	32N	3290.0	207.	257.	289.	319.	357.	384.	412.	215.	343.	123.	346.5	.754	.526	2.932	54.2	-.069	2.741	A23
04JD005	1958-82	15N	2020.0	191.	230.	252.	270.	292.	306.	320.	192.	282.	113.	337.6	.551	.227	3.361	45.6	-.009	3.909	A16
04JK001	1949-83	16N	5360.0	166.	235.	286.	339.	415.	475.	540.	185.	388.	94.	307.8	.855	1.544	6.212	77.7	-.020	4.255	A17
04KA001	1973-82	10N	4250.0	401.	620.	794.	982.	1257.	1489.	1742.	485.	821.	246.	277.6	.561	.553	4.998	204.9	-.356	4.387	B67
04LJ001	1920-82	63N	8940.0	888.	1124.	1260.	1381.	1525.	1626.	1723.	909.	1790.	409.	370.2	.668	.570	4.176	267.2	.007	3.434	A14
04LN001	1973-82	10N	22900.0	2244.	2501.	2729.	2840.	2955.	3026.	3087.	2264.	2857.	1590.	338.9	.532	-.323	5.204	402.0	-.064	5.274	B29
04MF001	1967-82	16N	6680.0	773.	913.	964.	999.	1030.	1048.	1062.	744.	1007.	307.	429.6	.612	-.551	3.980	199.5	-.214	3.018	B51
05PA006	1923-82	60N	13400.0	308.	425.	495.	558.	635.	690.	743.	324.	800.	91.	255.2	.987	.712	4.968	130.9	-.015	3.211	B13
05PB014	1921-82	62N	4870.0	116.	172.	207.	241.	285.	319.	352.	128.	305.	40.	238.2	.922	.717	3.569	57.6	-.093	2.511	A34
05PC010	1952-83	32N	168.0	20.	31.	38.	45.	55.	62.	70.	23.	59.	4.	200.0	.695	1.364	6.184	11.5	-.041	3.483	B24
05PC011	1952-82	31N	461.0	31.	55.	75.	98.	134.	165.	200.	39.	111.	12.	196.1	.700	1.084	5.100	22.6	-.341	2.339	A65
05PC016	1968-82	23N	243.0	30.	43.	51.	60.	71.	79.	88.	32.	72.	12.	232.5	.750	.872	4.940	13.9	-.109	2.886	A32
05PD022	1971-82	12N	.7	.13	.20	.27	.33	.43	.52	.61	.15	.31	.06	157.1	.400	1.043	4.239	.10	-.184	3.716	A46
05QA001	1922-81	68N	13900.0	262.	392.	482.	571.	692.	785.	881.	291.	719.	86.	273.4	.992	1.348	4.078	141.6	-.056	2.889	A22
05QA002	1922-82	61N	6230.0	141.	218.	272.	328.	403.	462.	524.	160.	449.	37.	287.3	.982	1.215	4.668	84.7	-.036	3.003	A11
05QA004	1962-82	21N	4450.0	97.	149.	190.	234.	299.	353.	412.	113.	226.	47.	283.1	.969	.832	3.137	52.5	-.177	2.881	A42
05QC003	1978-82	13N	2370.0	43.	60.	73.	86.	106.	122.	139.	49.	104.	27.	223.6	.920	2.003	.285	20.3	.045	6.068	B29
05QE008	1978-82	13N	1690.0	20.	35.	47.	61.	81.	98.	117.	25.	71.	7.	209.5	.963	1.806	7.437	17.3	-.013	4.486	A17
05QE009	1965-82	18N	1530.0	38.	55.	70.	88.	116.	140.	168.	44.	98.	25.	222.9	.901	1.702	7.268	18.3	-.266	3.149	A52
02AB001	1922-56=	35R	3630.0	74.	141.	207.	288.	424.	552.	705.	103.	335.	28.	256.7	.694	1.436	4.719	77.2	-.382	2.877	A22
02AB004	1924-82=	59R	3760.0	76.	132.	180.	235.	321.	396.	481.	97.	269.	25.	229.8	.557	1.334	4.304	64.7	-.218	2.926	A11
02AB005	1933-57=	25R	2560.0	155.	236.	291.	344.	414.	467.	521.	171.	379.	44.	275.8	.743	.994	4.251	88.9	-.046	3.344	A24
02AB006	1926-82=	57R	6480.0	230.	346.	433.	519.	636.	728.	824.	258.	644.	71.	297.8	.759	.894	3.503	127.0	-.092	2.656	A34
02AB009	1958-82=	25R	2800.0	148.	217.	266.	314.	379.	430.	483.	167.	372.	62.	284.6	.703	1.068	4.891	74.3	-.069	3.402	B24
02AB010	1924-82=	59R	6710.0	238.	352.	429.	504.	603.	678.	755.	261.	580.	68.	250.4	.708	.507	2.652	119.2	-.129	2.253	A36
02AB012	1952-77=	26R	174.0	3.58	5.86	7.73	9.79	12.85	15.45	18.33	4.32	13.55	1.45	237.9	.923	1.944	8.755	2.6	-.126	3.204	A33
02AB013	1952-82=	31R	526.0	12.	16.	18.	20.	22.	23.	25.	12.	20.	4.	169.4	.797	.046	2.178	4.7	-.020	2.177	A16
02AB015	1972-83=	12R	492.0	50.	69.	85.	103.	131.	155.	183.	56.	120.	34.	325.2	.616	2.127	9.163	23.3	-.004	4.853	A18

STATION NUMBER	DATA YEARS	AREA SQ.KM.	PREDICTED DISCHARGES (CMS) Q2	Q5	Q10	Q20	Q50	Q100	Q200	MEAN	RECORDED QMAX	QMIN	MAR MM.	BFI	CS	DISTRIBUTION CK	SD	PARAMETERS CS3	CK3	POR
02AC002	1971-82=12R	2980.0	95.	137.	174.	217.	283.	341.	408.	110.	237.	64.	256.3	.908	1.933	8.630	47.3	-.195	4.111	A57
02AD006	1927-43=17R	24500.0	374.	448.	493.	533.	582.	617.	651.	388.	507.	235.	345.7	.984	.102	2.486	76.7	-.114	2.478	B35
02AD008	1951-79=29R	24600.0	532.	593.	628.	658.	693.	718.	741.	537.	653.	434.	459.3	.763	-.025	2.148	68.1	-.177	2.117	C46
02BC004	1960-82=23R	4170.0	225.	280.	320.	362.	421.	469.	519.	242.	428.	165.	402.9	.840	1.494	6.582	61.6	-.034	3.654	B16
02BD001	1921-39=19R	1640.0	110.	147.	169.	187.	209.	224.	238.	112.	185.	45.	397.6	.766	.127	2.503	42.2	-.351	2.482	A25
02BD002	1934-52=34R	5130.0	214.	328.	420.	520.	667.	790.	925.	259.	728.	105.	442.5	.762	1.636	6.070	143.6	-.020	3.011	D11
02BD003	1966-82=17R	1930.0	162.	227.	288.	362.	482.	592.	722.	187.	381.	118.	453.4	.761	1.614	5.991	71.6	-.217	3.427	A54
02BE002	1952-72=31R	2880.0	131.	236.	337.	461.	667.	859.	1087.	174.	431.	60.	454.9	.563	1.244	3.968	109.9	-.224	2.731	A53
02CB001	1966-82=17R	4040.0	224.	295.	336.	373.	417.	448.	478.	231.	413.	98.	349.3	.311	.490	4.131	79.3	-.017	3.760	A16
02CB002	1951-67=17R	2150.0	117.	145.	162.	178.	197.	211.	225.	121.	214.	76.	419.5	.637	1.340	7.837	31.9	-.071	5.317	A23
02CC004	1921-50 30R	9270.0	466.	658.	807.	966.	1195.	1384.	1589.	521.	1060.	267.	381.1	.841	1.016	3.999	149.5	-.169	2.705	A44
02CC005	1945-82=38R	1960.0	176.	267.	334.	404.	502.	581.	665.	201.	497.	67.	454.6	.745	1.289	4.725	100.5	-.047	3.125	A22
02CC007	1951-83=33R	6840.0	372.	489.	558.	620.	696.	750.	802.	396.	701.	34.	377.2	.559	.617	3.614	124.4	.006	3.723	B16
02CC008	1962-82=21R	9300.0	531.	673.	768.	859.	979.	1070.	1162.	567.	952.	329.	423.7	.642	1.160	5.127	157.8	.034	4.432	A17
02CC009	1963-82=20R	9010.0	489.	651.	777.	911.	1104.	1263.	1435.	545.	1000.	341.	390.7	.573	1.339	5.548	177.1	-.111	3.698	B36
02CE001	1948-82=35R	11400.0	587.	818.	978.	1136.	1348.	1513.	1682.	546.	1336.	271.	365.3	.714	.384	4.010	250.9	-.047	3.216	B23
02CE002	1921-82 62R	1350.0	111.	152.	179.	203.	234.	257.	280.	118.	278.	37.	423.5	.764	1.256	5.421	46.8	.071	3.325	A26
02CE004	1921-82=62R	6800.0	331.	493.	602.	707.	845.	951.	1058.	364.	893.	84.	382.0	.713	1.117	4.324	181.2	.003	3.260	A13
02CF004	1954-82=29R	4190.0	275.	353.	396.	432.	473.	501.	528.	277.	465.	80.	356.3	.895	.173	3.260	91.0	.001	3.623	A15
02CF005	1959-82 24R	89.1	22.	29.	34.	38.	43.	47.	51.	24.	38.	13.	506.2	.373	.366	2.550	7.2	-.127	2.436	A35
02DB003	1923-52=30R	2820.0	129.	167.	191.	212.	238.	256.	274.	133.	225.	67.	436.2	.807	.488	3.185	42.8	-.037	3.003	A11
02DB005	1923-82=30R	3130.0	154.	213.	254.	292.	343.	382.	422.	165.	325.	67.	373.8	.790	.977	3.789	66.3	-.009	3.463	A14
02DC003	1922-82=61R	6660.0	328.	442.	519.	594.	693.	768.	845.	352.	958.	142.	422.9	.778	1.316	6.991	133.4	.076	3.884	A26
02DC004	1942-61=20R	2960.0	165.	232.	281.	330.	398.	452.	508.	181.	422.	87.	429.5	.832	1.669	7.751	76.4	-.038	3.803	A16
02DC005	1945-62=18R	2460.0	95.	130.	156.	182.	218.	247.	277.	104.	181.	54.	418.7	.735	.670	4.367	36.3	-.133	3.006	A31
02DC007	1941-72=32R	1360.0	55.	78.	94.	110.	130.	146.	162.	60.	114.	20.	329.4	.758	.584	2.716	24.9	-.095	2.666	A34
02DC008	1939-82=44R	2360.0	97.	133.	158.	183.	214.	239.	263.	104.	232.	38.	422.0	.706	1.761	8.705	43.1	.065	3.950	A26
02DC009	1949-76=28R	298.0	29.	37.	42.	47.	53.	58.	63.	30.	50.	16.	453.0	.453	.584	2.392	8.7	-.072	2.843	A22
02DD001	1914-36=23R	761.0	99.	129.	146.	163.	182.	197.	211.	104.	174.	48.	498.3	.646	.507	3.496	32.2	-.034	3.472	B14
02DD002	1920-52=33R	420.0	36.	47.	53.	59.	66.	71.	76.	38.	68.	18.	544.6	.691	.546	3.103	11.8	-.025	3.278	B13
02DD004	1931-62=32R	13900.0	372.	429.	462.	493.	530.	557.	584.	379.	590.	259.	402.2	.936	1.048	8.044	64.6	.058	4.458	A27
02DD005	1937-82=46R	787.0	87.	117.	139.	161.	192.	216.	241.	94.	175.	48.	471.4	.583	.882	3.410	32.5	-.134	2.676	A34
02DD007	1952-82=31R	12300.0	327.	375.	403.	426.	453.	472.	490.	329.	524.	189.	415.4	.917	.322	8.096	56.0	.108	7.145	A39
02DD010	1962-82=21R	13900.0	382.	428.	455.	479.	508.	528.	548.	386.	526.	283.	413.7	.934	.664	4.933	52.9	.025	4.416	A17
02DD012	1973-83=11R	741.0	134.	167.	186.	201.	220.	233.	245.	135.	202.	71.	522.3	.462	.194	3.323	38.1	-.020	4.010	A17
02EB002	1915-29=15R	1730.0	103.	127.	141.	152.	166.	175.	184.	107.	155.	20.	532.4	.830	.170	3.531	26.8	-.038	3.546	B15
02EB003	1932-48=17R	1710.0	87.	103.	112.	121.	132.	141.	149.	91.	125.	67.	459.1	.839	.910	3.840	16.1	-.090	3.410	B24
02EB004	1916-82=67R	1390.0	127.	154.	171.	185.	202.	214.	226.	130.	198.	59.	538.1	.617	.625	4.292	30.8	-.002	3.312	A14
02EB085	1924-37=14R	4840.0	228.	285.	329.	375.	441.	494.	552.	243.	370.	168.	508.3	.825	.941	3.847	60.1	-.135	3.515	A35
02EB086	1938-82=45R	4770.0	282.	323.	343.	358.	374.	385.	394.	281.	378.	159.	494.3	.715	-.324	3.245	50.8	-.014	3.099	B12
02EB087	1948-62=23R	1440.0	134.	155.	165.	172.	180.	185.	189.	133.	169.	77.	505.6	.636	-.132	2.717	27.3	-.092	2.420	B35
02EB088	1942-82=41R	1390.0	84.	102.	112.	120.	129.	134.	140.	84.	128.	34.	516.5	.794	-.056	3.237	22.1	-.002	3.212	B13
02EC003	1965-82=18R	5850.0	221.	242.	254.	265.	277.	286.	294.	222.	263.	180.	490.6	.697	-.058	2.824	24.3	-.253	2.916	C51
02EC004	1963-82=20R	3700.0	87.	105.	114.	120.	127.	131.	135.	86.	122.	44.	235.1	.680	-.275	3.132	23.2	-.052	3.109	B22
02EC012	1970-82 13R	324.0	33.	48.	61.	77.	102.	125.	151.	38.	87.	23.	253.7	.496	.852	3.862	13.5	-.355	3.122	A62
02ED100	1969-82 14R	86.0	12.	18.	22.	27.	34.	40.	47.	14.	26.	7.	209.3	.572	.910	3.874	5.7	-.200	3.272	A53
02FB001	1921-51=31R	254.0	14.	22.	29.	37.	48.	57.	67.	16.	45.	5.	191.7	.681	1.131	5.232	9.1	-.215	2.587	A54
02FB003	1916-51=36R	262.0	22.	30.	36.	42.	49.	55.	61.	24.	55.	9.	458.0	.681	1.357	6.006	9.7	-.007	3.581	A15
02FB009	1961-82=22R	572.0	59.	73.	81.	88.	96.	101.	107.	61.	96.	31.	435.3	.587	.293	3.696	15.6	-.014	3.644	B15
02FC012	1972-82 11R	635.0	169.	219.	253.	286.	328.	361.	394.	178.	251.	108.	464.6	.415	.234	2.568	51.6	-.173	2.981	A41
02FC013	1972-82 11R	262.0	37.	48.	56.	64.	74.	82.	91.	40.	69.	25.	549.6	.674	1.443	7.272	11.8	-.032	4.822	A18
02FE003	1953-79 27R	77.7	36.	51.	61.	69.	80.	88.	96.	39.	79.	8.	386.1	.283	.669	3.686	17.0	-.008	3.673	B15
02FE005	1953-82 30R	528.0	159.	248.	307.	362.	434.	488.	543.	175.	374.	30.	424.2	.458	.448	2.581	94.4	-.111	2.494	A35
02FE007	1968-82 15R	326.0	102.	152.	186.	220.	267.	303.	340.	113.	231.	50.	403.2	.402	.599	2.969	51.8	.005	2.593	C14
02GA013	1948-57=10R	821.0	434.	728.	955.	1194.	1537.	1819.	2123.	509.	1056.	153.	376.4	.342	.636	3.976	287.5	-.255	3.453	A54
02GA014	1948-81=17R	694.0	211.	278.	334.	395.	487.	564.	650.	243.	447.	149.	373.2	.268	1.116	4.053	96.0	-.071	2.989	D21
02GA022	1953-64 12R	655.0	156.	208.	241.	272.	311.	340.	369.	169.	289.	84.	299.2	.266	.823	5.684	55.4	-.037	5.324	B19
02GA023	1958-82=25R	118.0	34.	48.	57.	65.	75.	82.	90.	37.	80.	14.	335.5	.365	.969	5.356	15.0	-.007	3.913	B16
02GA024	1960-82=23R	59.6	14.	25.	35.	47.	67.	85.	106.	18.	45.	7.	263.3	.359	1.306	4.287	11.2	-.255	2.976	A51
02GA028	1960-82=23R	578.0	120.	210.	279.	352.	456.	540.	631.	145.	447.	24.	359.9	.572	1.385	6.333	96.9	-.142	3.042	A41
02GA029	1966-82 17R	236.0	29.	42.	51.	60.	72.	82.	91.	31.	48.	11.	336.4	.561	-.191	2.256	12.1	-.694	3.054	C01
02GA033	1954-82 29R	64.8	13.00	20.00	25.00	30.00	37.00	42.00	47.00	15.00	42.00	3.00	344.1	.455	1.508	5.877	8.3	.032	4.045	B17
02GA034	1968-82=15R	1170.0	257.	397.	526.	680.	926.	1150.	1410.	311.	674.	156.	373.5	.439	1.475	5.110	159.2	-.103	3.784	A36
02GB010	1962-82 21R	171.0	22.	29.	33.	37.	41.	44.	47.	23.	43.	9.	301.2	.361	.384	4.229	8.2	-.003	3.803	A16
02GC002	1967-82 16R	329.0	135.	182.	216.	250.	297.	333.	372.	146.	275.	79.	367.8	.258	1.075	5.087	50.4	-.037	3.474	A34
02GC005	1955-66=12R	54.4	7.19	15.37	22.87	31.75	45.94	58.75	73.61	10.87	44.99	2.16	314.3	.620	2.334	.021	12.1	.650	3.989	C86
02GC006	1956-82 27R	363.0	33.	58.	78.	99.	130.	156.	185.	41.	146.	10.	327.8	.694	2.136	9.526	29.3	-.173	3.489	A24

TABLE A14.1 (SHEET 4 OF 6)

STATION NUMBER	DATA YEARS	TOT	AREA SQ.KM.	PREDICTED DISCHARGES (CMS) Q2	Q5	Q10	Q20	Q50	Q100	Q200	MEAN	RECORDED QMAX	QMIN	MAR MM.	BFI	CS	DISTRIBUTION PARAMETERS CK	SD	CS3	CK3	PDR
02GC008	1958-82	25R	134.0	17.	28.	36.	44.	56.	65.	75.	20.	60.	5.	373.9	.726	1.554	7.400	11.9	-.105	3.171	A32
02GC010	1961-82	22R	342.0	60.	91.	114.	136.	165.	189.	213.	67.	146.	17.	353.8	.522	.895	3.415	34.3	-.037	3.384	A14
02GC013	1964-82	19R	75.9	14.	23.	29.	34.	41.	47.	52.	16.	41.	6.	400.5	.481	1.197	4.668	9.9	.584	3.007	A71
02GC014	1967-78	12R	65.8	6.00	10.00	12.00	15.00	19.00	23.00	26.00	7.00	13.00	2.00	370.8	.767	.435	2.654	3.6	-.211	3.135	A52
02GC017	1965-82	18R	93.2	22.	30.	34.	39.	43.	47.	50.	22.	39.	8.	389.5	.497	.124	2.458	9.1	-.061	2.433	A25
02GC022	1972-82≡11R		101.0	29.	41.	50.	60.	75.	87.	100.	32.	60.	18.	331.5	.459	1.309	5.299	12.7	-.083	4.427	A27
02GD004	1946-82	37R	306.0	93.	149.	188.	226.	278.	318.	360.	106.	412.	18.	369.3	.404	2.507	3.313	68.9	.096	4.427	A37
02GD005	1948-82	35R	1080.0	429.	580.	659.	725.	799.	849.	895.	438.	770.	109.	379.6	.321	.036	2.678	174.0	-.006	2.673	B14
02GD007	1944-62≡19R		1700.0	459.	754.	978.	1212.	1543.	1812.	2100.	528.	1020.	109.	356.5	.388	.054	2.726	251.9	-.880	3.767	C86
02GD008	1973-82	10R	200.0	94.	118.	133.	145.	161.	172.	183.	96.	146.	57.	387.0	.348	.342	4.134	26.9	-.061	3.866	A26
02GD011	1952-82	31R	93.2	23.	39.	50.	62.	79.	93.	108.	28.	68.	6.	315.5	.356	1.052	3.518	16.7	-.066	3.096	A22
02GD014	1955-82	28R	319.0	217.	304.	362.	417.	490.	545.	601.	238.	447.	89.	416.9	.262	.762	3.311	93.2	-.038	3.341	B14
02GD015	1954-82	29R	1340.0	508.	650.	718.	772.	830.	867.	899.	506.	867.	142.	385.8	.371	-.256	3.198	173.6	-.014	3.296	B14
02GD016	1957-82≡26R		518.0	72.	108.	133.	158.	192.	219.	246.	82.	194.	28.	334.0	.517	1.229	5.237	39.8	-.030	3.706	B16
02GD018	1965-82	18R	144.0	56.	74.	86.	99.	115.	128.	141.	60.	97.	34.	436.8	.343	.535	3.078	18.7	-.164	2.699	A44
02GE002	1955-82	28R	3110.0	668.	831.	905.	960.	1018.	1054.	1085.	657.	977.	245.	376.2	.451	-.355	3.083	208.1	-.056	2.859	B22
02GE003	1955-82	28R	4300.0	545.	702.	786.	856.	937.	991.	1042.	557.	960.	229.	367.4	.493	.103	3.233	179.3	-.019	3.103	B12
02GE006	1973-82	10R	3760.0	522.	642.	779.	966.	1309.	1658.	2103.	576.	940.	464.	436.2	.511	2.210	9.697	141.3	-.357	4.561	A66
02HA007	1958-82≡25R		230.0	48.	64.	74.	84.	97.	106.	116.	51.	107.	22.	300.9	.182	1.445	6.649	18.3	.066	4.413	A27
02HB001	1925-82	58R	205.0	22.	33.	41.	48.	58.	66.	75.	25.	65.	7.	271.2	.651	1.429	5.557	12.4	.026	3.510	B15
02HB004	1957-82	26R	199.0	59.	84.	100.	116.	136.	151.	166.	63.	162.	21.	244.7	.260	1.588	8.072	26.6	.044	4.256	A27
02HB005	1959-82≡24R		95.6	17.	23.	28.	32.	38.	43.	48.	18.	45.	8.	394.4	.528	1.835	9.531	7.6	-.020	3.839	A16
02HB011	1964-82	19R	235.0	23.	29.	32.	36.	40.	42.	45.	24.	34.	14.	361.7	.639	-.062	2.866	5.9	-.508	2.975	C71
02HB013	1968-82≡15R		62.2	6.00	9.00	11.00	13.00	16.00	18.00	21.00	7.00	18.00	3.00	303.9	.633	2.279	1.075	3.5	.080	6.256	A29
02HB015	1973-82≡10R		63.5	6.00	8.00	9.00	10.00	11.00	12.00	13.00	6.00	10.00	3.00	348.6	.627	.961	5.166	2.1	.013	5.391	A19
02HC005	1951-82≡32R		88.1	25.	43.	58.	75.	99.	119.	142.	31.	99.	6.	280.4	.346	1.717	5.872	22.6	.041	3.661	A25
02HC022	1965-82≡18R		186.0	43.	53.	59.	64.	69.	73.	76.	44.	72.	20.	239.2	.370	.362	6.085	11.5	.025	5.987	B19
02HC024	1972-82	11R	316.0	141.	159.	166.	171.	176.	179.	181.	140.	174.	93.	379.7	.486	-.032	5.493	24.8	-.055	5.619	B29
02HC034	1966-81≡16R		194.0	50.	60.	65.	70.	75.	78.	81.	51.	72.	29.	201.5	.170	.351	4.163	11.5	-.003	4.170	B17
02HD006	1960-82	23R	82.9	26.	45.	61.	81.	111.	138.	169.	33.	135.	10.	482.5	.590	2.904	3.290	27.8	.092	4.345	A37
02HF002	1963-82≡20R		1280.0	51.	63.	70.	77.	84.	89.	94.	52.	81.	29.	493.8	.855	.316	3.501	13.9	-.028	3.213	A13
02HF003	1966-82	17R	1270.0	112.	139.	157.	176.	201.	222.	242.	120.	191.	84.	464.6	.661	1.052	5.771	27.7	-.129	3.644	B35
02HH002	1972-83≡12R		326.0	24.	32.	36.	41.	47.	51.	55.	25.	33.	14.	417.2	.650	.701	3.080	3.6	-.034	4.119	A17
02HJ002	1966-82≡17R		7360.0	307.	376.	417.	455.	502.	535.	568.	315.	447.	183.	360.1	.697	-.495	4.095	67.9	-1.040	4.262	C97
02HK002	1950-80≡31R		9090.0	315.	394.	442.	486.	541.	581.	620.	326.	594.	182.	319.6	.703	.942	5.191	88.1	.013	3.801	A16
02HK003	1953-82≡20R		1990.0	122.	158.	181.	204.	233.	256.	278.	129.	229.	75.	363.3	.657	.939	4.505	38.9	-.050	3.475	A24
02HK004	1967-82≡16R		12000.0	522.	612.	664.	709.	763.	801.	837.	529.	705.	362.	370.0	.735	.247	3.055	101.1	-.039	3.150	A12
02HK005	1969-82≡14R		456.0	42.	49.	54.	59.	66.	72.	79.	45.	69.	36.	462.7	.759	2.441	2.995	8.2	.085	5.312	B29
02HL001	1916-82≡67R		2620.0	212.	267.	297.	323.	352.	373.	392.	216.	366.	83.	361.1	.709	.215	3.021	62.4	-.008	2.976	B11
02HL003	1965-82≡18R		401.0	51.	64.	72.	79.	87.	93.	99.	52.	80.	27.	384.0	.602	.352	3.031	14.7	-.044	3.166	A22
02HM001	1952-73	22R	777.0	61.	80.	92.	102.	114.	123.	131.	64.	101.	30.	370.7	.644	.255	2.557	20.9	-.066	2.613	A24
02HM002	1957-82≡26R		189.0	11.	14.	17.	20.	24.	27.	30.	12.	21.	7.	312.2	.668	1.026	3.947	3.7	-.135	2.895	A32
02HM003	1959-82	24R	891.0	74.	96.	110.	123.	139.	151.	163.	77.	152.	35.	365.9	.770	1.152	5.893	25.3	.042	4.316	A27
02HM006	1971-83≡13R		150.0	19.	24.	27.	31.	35.	38.	41.	19.	31.	11.	463.3	.633	.754	4.035	5.8	-.044	4.009	A27
02HM007	1974-83≡10R		694.0	53.	65.	72.	78.	86.	92.	97.	55.	78.	35.	403.5	.776	.423	4.331	12.6	-.051	4.176	A27
02JD004	1938-57≡20R		4120.0	217.	258.	282.	303.	329.	348.	366.	221.	301.	153.	359.2	.776	.157	2.354	45.1	-.080	2.359	A25
02JD005	1937-57≡21R		3420.0	183.	232.	273.	318.	387.	446.	512.	198.	279.	140.	348.0	.718	.427	2.293	45.3	-.319	2.392	A65
02JD006	1924-57≡34R		3420.0	170.	219.	254.	289.	337.	375.	415.	183.	334.	29.	374.3	.809	1.020	4.543	52.2	-.105	2.943	B31
02JD008	1931-70≡40R		6480.0	310.	438.	529.	620.	744.	842.	944.	342.	880.	128.	395.1	.779	1.531	6.384	147.7	.067	3.665	A25
02JD009	1969-82≡14R		4300.0	278.	358.	409.	456.	515.	559.	603.	291.	522.	138.	341.9	.778	1.253	4.884	96.0	.789	3.557	C85
02JD010	1972-82≡11R		6600.0	377.	439.	475.	507.	545.	572.	599.	383.	589.	319.	368.2	.233	2.078	9.175	77.9	1.667	7.414	C99
02JD011	1947-82≡36R		1370.0	67.	93.	110.	128.	151.	168.	187.	73.	155.	34.	450.4	.741	1.018	4.367	27.6	-.072	2.971	A21
02JD012	1946-82≡37R		1780.0	125.	180.	225.	275.	350.	413.	484.	144.	320.	76.	375.8	.593	.357	4.357	58.5	-.181	.815	49
02JE003	1912-51≡40R		46100.0	1930.	2476.	2812.	3120.	3504.	3782.	4057.	2304.	3542.	1001.	464.2	.898	.482	3.159	596.2	-.065	2.613	A24
02JE012	1953-82	30R	47900.0	1586.	2179.	2609.	3048.	3653.	4134.	4640.	1731.	3653.	941.	453.0	.707	1.021	5.146	615.5	-.185	2.529	A44
02JE019	1972-82≡11R		1130.0	82.	97.	106.	113.	123.	129.	136.	84.	115.	61.	477.3	.787	.268	4.299	16.0	-.187	3.926	C46
02JE020	1972-82≡11R		909.0	87.	101.	111.	122.	137.	149.	162.	92.	112.	76.	536.9	.590	.218	3.395	12.9	-.310	3.599	365
02JE021	1947-81≡35R		749.0	40.	60.	75.	92.	115.	133.	154.	46.	112.	19.	407.2	.593	1.306	4.598	22.3	-.068	3.141	A22
02KA002	1951-82≡32R		57500.0	2070.	2745.	3200.	3641.	4223.	4667.	5120.	2210.	4896.	1092.	448.7	.733	1.662	7.303	786.7	.075	4.218	A27
02KB001	1916-82≡67R		4120.0	207.	273.	312.	348.	392.	423.	454.	216.	403.	85.	361.7	.882	.416	2.854	72.5	-.053	2.573	B24
02KB009	1922-57≡36R		2380.0	124.	185.	226.	265.	317.	356.	396.	136.	378.	31.	254.6	.803	1.362	6.291	69.4	.014	3.642	A15
02KC015	1969-78≡10R		668.0	44.	54.	61.	66.	74.	79.	84.	45.	57.	27.	300.9	.719	-.672	3.225	10.2	-.322	4.044	C97
02KD001	1916-42≡27R		1370.0	93.	131.	158.	184.	219.	246.	274.	103.	210.	42.	422.6	.868	1.004	4.356	41.6	-.052	3.411	B24
02KD002	1940-82≡43R		837.0	65.	84.	94.	102.	112.	118.	124.	66.	106.	25.	440.3	.688	.031	2.197	21.3	-.210	2.209	A16
02KD004	1939-82≡53R		5800.0	220.	309.	366.	420.	489.	541.	593.	235.	498.	73.	365.5	.809	.545	2.918	94.9	-.086	2.472	A25
02KD006	1942-57≡16R		1010.0	74.	125.	165.	210.	275.	331.	392.	93.	191.	34.	413.9	.651	.697	3.285	49.7	-.233	3.386	B54

TABLE A14.1 (SHEET 5 OF 6)

STATION NUMBER	DATA YEARS	TOT	AREA SQ.KM.	PREDICTED DISCHARGES (CMS) Q2	Q5	Q10	Q20	Q50	Q100	Q200	MEAN	RECORDED QMAX	QMIN	MAR MM.	BFI	CS	DISTRIBUTION PARAMETERS CK	SD	CS3	CK3	POR
02KD007	1943-82	40R	2720.0	110.	145.	169.	193.	226.	251.	277.	118.	229.	60.	378.7	.668	1.103	4.357	38.8	-.034	3.146	A12
02KF002	1924-50	27R	8260.0	347.	455.	520.	580.	654.	708.	760.	361.	629.	146.	341.4	.830	.636	3.631	119.4	-.014	3.406	A14
02KE003	1938-51	14R	8000.0	354.	541.	678.	818.	1013.	1169.	1334.	400.	883.	143.	317.5	.601	1.128	5.028	200.9	-.089	3.763	A26
02KE005	1949-79	31R	8160.0	359.	462.	518.	565.	621.	659.	694.	364.	610.	163.	345.6	.455	.104	2.504	117.9	-.024	2.456	A15
02KF006	1919-82	64R	2900.0	145.	186.	208.	227.	249.	263.	277.	146.	263.	49.	336.6	.803	.099	2.571	48.2	-.012	2.513	A14
02KF007	1920-57	38R	1040.0	44.	65.	80.	95.	116.	132.	148.	49.	108.	18.	383.7	.795	.789	3.391	22.6	-.130	2.988	A34
02KF010	1971-82	12R	614.0	73.	87.	95.	104.	114.	122.	129.	77.	104.	56.	382.7	.634	.863	5.563	14.4	-.020	5.583	B19
02KF012	1972-82	11R	203.0	29.	35.	39.	42.	45.	47.	49.	29.	41.	18.	375.4	.613	.045	3.683	7.5	-.038	3.664	A15
02KF013	1972-82	11R	280.0	32.	38.	42.	45.	48.	51.	53.	32.	45.	20.	385.7	.665	.179	3.999	7.3	-.018	4.043	A17
02LA004	1949-82	34R	3830.0	418.	498.	533.	559.	585.	601.	615.	409.	597.	146.	315.9	.516	-.775	4.142	107.6	.006	3.720	B16
02LA005	1973-82	10R	1290.0	63.	84.	98.	111.	128.	140.	152.	66.	95.	42.	351.9	.726	.667	2.295	21.9	-.084	2.207	C26
02MB005	1938-58	21R	772000.0	7853.	8460.	8796.	9083.	9417.	9646.	9862.	7882.	9180.	6802.	.0	.994	-.014	2.579	692.5	-.148	2.505	C45
02MB006	1971-82	12R	80.0	31.	38.	43.	47.	52.	56.	60.	32.	45.	13.	647.5	.385	.290	3.118	8.3	-.082	3.236	A23
02MC002	1968-81	14R	774000.0	8738.	9347.	9734.	10096.	10556.	10896.	11235.	8831.	9972.	7936.	.0	.987	.529	3.466	655.5	-.084	3.353	A24
04FA002	1968-82	15R	1540.0	61.	80.	91.	101.	112.	119.	126.	61.	102.	26.	354.5	.853	.153	3.269	22.8	-.024	3.213	A13
04GC002	1971-82	12R	16300.0	125.	220.	296.	378.	497.	597.	706.	164.	677.	57.	108.0	.958	2.965	3.417	169.2	1.455	7.000	C99
04GD001	1967-79	13R	32400.0	636.	858.	1029.	1210.	1470.	1683.	1913.	698.	1350.	401.	248.5	.958	1.586	7.135	248.1	-.061	4.208	A27
04HA001	1967-82	16R	118000.0	4704.	5794.	6468.	7088.	7862.	8426.	8982.	4850.	7396.	3050.	258.5	.863	.436	3.502	1182.2	-.083	3.020	A21
04JD002	1939-64	26R	4270.0	197.	273.	317.	355.	400.	432.	462.	207.	427.	45.	61.8	0.000	.566	4.804	85.7	.020	4.428	B17
04JG001	1967-82	16R	26200.0	1924.	2351.	2611.	2847.	3139.	3349.	3555.	1974.	2636.	1120.	355.7	.751	-.017	2.837	448.5	-.504	3.772	C76
04LA002	1969-82	14R	5540.0	234.	303.	350.	395.	455.	500.	547.	247.	400.	143.	371.8	.792	.736	3.770	73.6	-.086	3.549	A25
04LB001	1920-76	57R	10000.0	655.	846.	965.	1076.	1215.	1317.	1419.	684.	1256.	301.	360.0	.647	.776	3.445	212.2	.007	3.275	A13
04LC001	1933-61	29R	3370.0	169.	231.	271.	310.	359.	396.	433.	180.	464.	65.	326.4	.628	1.979	.484	73.6	.115	4.933	A38
04LD001	1921-82	62R	11900.0	926.	1193.	1359.	1512.	1703.	1843.	1981.	965.	1834.	426.	384.0	.713	.714	3.563	295.9	-.013	3.069	A11
04LF001	1919-82	64R	6760.0	505.	636.	713.	780.	860.	916.	970.	516.	969.	214.	362.4	.684	.507	3.712	149.2	.003	3.329	A14
04LG001	1927-82	56R	34700.0	2634.	3288.	3690.	4058.	4516.	4848.	5174.	2723.	5108.	1344.	383.3	.653	.826	4.233	732.7	.010	3.408	A14
04LG002	1963-82	20R	60100.0	5256.	6295.	6991.	7664.	8550.	9226.	9914.	5524.	8330.	3880.	409.3	.693	.962	4.653	1106.0	-.068	3.583	B25
04LG003	1964-82	19R	34700.0	2679.	3312.	3807.	4335.	5098.	5729.	6414.	2867.	5108.	2017.	397.7	.652	1. 44	7.481	729.6	-.026	3.805	A16
04MB003	1955-82	28R	238.0	15.	22.	28.	35.	45.	54.	63.	18.	78.	8.	315.1	.667	4.124	2.872	12.7	.292	5.472	A69
04MC001	1920-82	63R	13300.0	732.	901.	987.	1057.	1135.	1186.	1233.	732.	1165.	248.	427.1	.371	-.051	2.421	201.6	-.009	2.445	B15
04MC002	1950-82	33R	9950.0	439.	614.	724.	825.	953.	1046.	1139.	465.	781.	191.	410.1	.403	.280	3.182	187.4	-.104	2.277	A36
04MD002	1939-82	44R	2870.0	190.	256.	299.	341.	396.	438.	480.	203.	447.	85.	351.9	.485	1.384	5.511	75.9	.069	3.958	A26
04MF001	1928-67	40R	20700.0	1360.	1659.	1828.	1973.	2144.	2263.	2376.	1390.	2017.	752.	420.3	.520	.171	2.451	335.3	-.035	2.521	B14
04MF002	1932-82	51R	22900.0	1480.	1910.	2213.	2515.	2924.	3244.	3576.	1578.	2557.	943.	417.9	.636	.583	2.437	446.4	-.137	2.383	A35
04ME003	1960-82	23R	27500.0	1799.	2436.	2973.	3575.	4486.	5271.	6151.	2006.	3428.	1250.	447.3	.656	1.015	3.607	647.8	-.235	2.799	A53
04ME004	1962-83	22R	9950.0	1579.	2023.	2334.	2643.	3061.	3385.	3723.	1679.	3220.	1000.	1085.4	.603	1.491	6.853	498.7	-.027	3.713	A16
05PA012	1930-82	53R	4510.0	155.	212.	248.	281.	322.	353.	383.	165.	442.	52.	274.9	.869	1.488	8.603	65.1	.055	4.174	B27
05PB009	1964-82	19R	5880.0	127.	174.	204.	231.	266.	291.	316.	134.	226.	91.	248.3	.770	.231	2.467	50.4	-.124	2.369	A35
05PC018	1929-82	54R	50200.0	1043.	1403.	1605.	1780.	1985.	2127.	2261.	1066.	2030.	322.	227.1	.827	.190	2.567	409.7	-.029	2.480	A15
05PC019	1923-82	60R	38600.0	645.	1006.	1269.	1537.	1907.	2202.	2512.	723.	1366.	149.	225.6	.775	-.318	2.363	294.8	-1.067	3.346	C94
05QC001	1963-82	20R	4920.0	93.	118.	136.	152.	174.	191.	206.	100.	205.	58.	202.8	.913	2.231	2.022	30.9	.139	5.977	B39
05QD002	1928-53	26R	6450.0	137.	202.	245.	285.	337.	376.	415.	148.	325.	43.	192.2	.780	.563	3.355	70.2	-.100	2.885	A34
05QD003	1971-82	12R	2510.0	35.	59.	75.	91.	112.	128.	144.	40.	97.	19.	197.3	.914	1.299	4.550	27.5	.967	3.564	A95
05QD006	1954-82	29R	6370.0	146.	197.	229.	260.	299.	329.	358.	154.	276.	68.	224.5	.825	.576	3.178	54.9	-.081	2.755	A23
05QD016	1971-82	12R	2300.0	43.	86.	123.	165.	230.	287.	353.	56.	121.	13.	169.1	.805	.307	2.660	37.6	-.339	2.481	C65
05QE005	1959-82	24R	52300.0	727.	921.	1057.	1192.	1375.	1516.	1663.	770.	1269.	511.	275.3	.882	.606	3.597	230.8	-.168	2.563	A44
05QE006	1929-82	54R	26400.0	391.	546.	654.	759.	901.	1010.	1123.	426.	1011.	171.	253.8	.937	1.366	5.643	174.7	-.013	3.262	A13
05QE007	1957-82	26R	37000.0	564.	684.	770.	857.	977.	1072.	1171.	593.	910.	421.	294.6	.679	1.016	3.860	129.4	-.073	3.155	A22

TABLE A14.1 (SHEET 6 OF 6)

TOTAL NUMBER OF STATIONS: 395 NATURAL:204 REGULATED:191

* - DENOTES STATION HAVING MINOR REGULATION (CLASSIFIED AS NATURAL FOR CALCULATIONS)
= - DENOTES STATION HAVING HEAVY REGULATION
MAR BASED ON PUBLISHED W.S.C. DATA

STATION PARAMETER STATISTICS FOR SELECTED STATIONS - ALL REGIONS

---NOTE--- THE FOLLOWING STATISTICS DO NOT INCLUDE DATA WHICH ARE LESS THAN 10 YEARS

RETURN PERIOD	SP. DISCHARGE (NATURAL) MAX	MIN	MED	MEAN	STD	CV	SP. DISCHARGE (REGULATED) MAX	MIN	MED	MEAN	STD	CV	SP. DISCHARGE (TOTAL) MAX	MIN	MED	MEAN	STD	CV
2	.88	.01	.17	.21	.17	1.00	.68	.01	.07	.11	.11	1.68	.88	.01	.11	.16	.15	1.39
5	1.85	.01	.25	.31	.28	1.10	.95	.01	.09	.15	.16	1.80	1.85	.01	.15	.23	.24	1.59
10	2.72	.01	.31	.39	.37	1.21	1.16	.01	.10	.18	.20	1.89	2.72	.01	.18	.29	.32	1.75
20	3.75	.01	.37	.47	.48	1.29	1.45	.01	.12	.21	.23	2.04	3.75	.01	.21	.34	.40	1.92
50	5.37	.01	.44	.58	.66	1.48	1.87	.01	.13	.25	.29	2.20	5.37	.01	.25	.42	.54	2.16
100	6.82	.01	.49	.68	.82	1.68	2.22	.01	.15	.29	.34	2.29	6.82	.01	.27	.49	.67	2.43
200	8.50	.01	.53	.78	1.02	1.93	2.59	.01	.16	.32	.40	2.42	8.50	.01	.30	.56	.81	2.76

STATISTICS OF AREAS

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
686000.0	.2	272.0	5456.9	48206.2	8.83	774000.0	54.4	1930.0	14749.3	79407.6	5.4	774000.0	.2	694.0	9950.2	65266.2	6.5

STATISTICS OF SKEWNESS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
1.32	-1.00	-.06	-.09	.24	-2.70	1.67	-1.07	-.04	-.06	.28	-5.03	1.67	-1.07	-.05	-.07	.26	-3.58

STATISTICS OF KURTOSIS FOR PLOTTED DISTRIBUTION

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
9.45	2.21	3.43	3.74	1.10	.29	7.41	.82	3.38	3.49	.94	.27	9.45	.82	3.41	3.62	1.03	.29

STATISTICS OF SP. MEAN (ARITHMETIC) / MEAN ANNUAL RUN OFF (MM.)/ BASE FLOOD INDEX

NATURAL DATA ONLY MAX	MIN	MED	MEAN	STD	CV	REGULATED DATA ONLY MAX	MIN	MED	MEAN	STD	CV	ALL DATA INCLUDED MAX	MIN	MED	MEAN	STD	CV
1.20	.01	.19	.24	.20	.85	.75	.01	.07	.12	.12	1.02	1.20	.01	.12	.18	.18	.99
625.50	125.36	345.31	349.14	91.67	.26	1085.4	.0	371.8	366.9	108.5	.3	1085.4	.0	359.6	357.7	100.4	.2
1.00	.15	.53	.53	.21	.40	.99	0.00	.68	.65	.19	.29	1.00	0.00	.60	.59	.21	.36

TABLE # A14.2

STATISTICS OF PEAK RATIOS FOR REGION 1

STATION NUMBER (WSC)	MID START YEAR	YEARS MID USED	DRAINAGE AREA (SQ.KM)	STATISTICS MID/MD MAX	MEAN	STD
02CA002	1971	11-N	108.0	2.00	1.24	.27
02CC005	1961	20-R	1960.0	1.13	1.03	.03
02CD001	1967	15-N	1350.0	1.03	1.01	.01
02CD003	1978	5-R	319.0	1.06	1.02	.03
02CD006	1970	8-N	157.0	1.04	1.01	.01
02CF005	1959	23-R	89.1	1.82	1.30	.24
02CF008	1975	8-N	155.0	1.11	1.05	.04
02CF010	1976	7-N	697.0	1.07	1.04	.02
02DB005	1969	13-R	3130.0	1.12	1.05	.03
02DD005	1961	21-R	787.0	1.26	1.08	.06
02DD009	1972	11-R	316.0	1.05	1.02	.02
02DD012	1973	9-N	741.0	1.06	1.03	.02
02DD014	1975	7-N	37.3	1.88	1.54	.24
02EA005	1967	16-N	321.0	1.03	1.01	.01
02EA010	1970	13-N	149.0	1.14	1.05	.05
02EB011	1966	17-R	4790.0	1.08	1.02	.02
02EB013	1974	9-N	593.0	1.12	1.06	.04
02HF002	1970	12-R	114.0	1.25	1.14	.06
02HF002	1963	20-R	1280.0	1.09	1.02	.02
02HF004	1976	7-N	21.8	1.50	1.18	.20
02HH002	1972	11-R	326.0	1.08	1.02	.03
02HK005	1969	14-R	456.0	1.04	1.01	.02
02HL001	1957	26-R	2620.0	1.02	1.01	.01
02HL004	1964	18-N	712.0	1.14	1.04	.03
02HL101	1970	5-R	1770.0	1.13	1.04	.05
02HL103	1973	5-N	199.0	1.05	1.03	.02
02HM002	1971	8-R	189.0	1.11	1.06	.05
02HM004	1965	9-N	112.0	1.17	1.11	.04
02HM007	1974	9-R	694.0	1.32	1.06	.10
02JD009	1969	13-R	4300.0	1.14	1.02	.04
02JE018	1972	5-N	62.9	1.50	1.17	.21
02JE020	1972	11-R	932.00	1.02	1.01	.01
02KA004	1968	15-N	.37	2.00	1.37	.26
02KA006	1968	14-N	.70	4.00	1.55	.77
02KA008	1972	10-N	.13	2.00	1.47	.34
02KC009	1963	16-R	2380.0	1.73	1.26	.22
02KC015	1970	5-R	668.0	1.24	1.09	.09
02KD004	1973	10-R	5800.0	1.02	1.01	.01
02KF006	1960	23-R	2300.0	1.01	1.01	.01
02KF012	1972	11-R	203.0	1.54	1.16	.15
02KF014	1975	8-R	277.0	1.11	1.03	.05
02LA005	1972	8-R	1290.0	1.10	1.05	.04
02LA007	1970	6-N	559.0	1.11	1.04	.04
02CB001	1964	7-R	4040.0	2.29	1.40	.51
02CC008	1961	21-R	9300.0	1.16	1.03	.05
02CD002	1978	5-R	109.0	1.11	1.02	.05
02CD004	1970	5-R	567.0	1.02	1.01	.01
02CE002	1959	24-R	1350.0	1.05	1.02	.01
02CF007	1962	17-N	272.0	1.29	1.04	.07
02CF009	1961	19-R	21.5	4.33	2.35	.89
02CF011	1971	5-N	704.0	1.08	1.03	.04
02DB006	1974	6-R	2750.0	1.06	1.03	.02
02DD008	1967	13-N	90.4	1.14	1.08	.05
02DD010	1963	18-R	13900.0	1.01	1.01	0.00
02DD013	1974	9-N	70.4	1.20	1.08	.06
02DD015	1975	7-N	106.0	1.13	1.03	.05
02EA006	1972	10-R	650.0	1.02	1.01	.01
02EA011	1974	8-R	2850.0	1.01	1.01	0.00
02EB012	1967	16-R	4740.0	1.19	1.05	.06
02HE001	1970	12-N	19.4	2.50	1.56	.42
02HE003	1970	8-N	29.3	1.40	1.20	.13
02HF003	1964	18-R	1270.0	1.08	1.02	.02
02HH001	1969	12-R	241.0	1.11	1.05	.04
02HK003	1966	17-R	1990.0	1.02	1.01	.01
02HK006	1975	6-R	541.0	1.03	1.02	.01
02HL003	1958	24-R	401.0	1.20	1.05	.04
02HL005	1966	16-N	308.0	1.05	1.02	.02
02HL102	1970	6-N	160.0	1.04	1.01	.02
02HM001	1956	17-R	777.0	1.92	1.12	.22
02HM003	1965	17-R	891.0	1.31	1.10	.08
02HM005	1970	8-N	155.0	1.23	1.09	.06
02JC008	1970	9-N	1780.0	1.12	1.05	.04
02JE014	1963	9-N	2060.0	1.24	1.04	.08
02JE019	1972	11-R	1140.0	1.09	1.02	.03
02KA003	1967	16-N	6.03	1.07	1.03	.02
02KA005	1968	15-N	3.44	1.45	1.15	.13
02KA007	1968	14-N	.21	2.50	1.29	.39
02KB001	1966	17-R	4120.00	1.02	1.01	.01
02KC014	1970	7-N	443.0	1.12	1.05	.03
02KD002	1967	16-R	837.0	1.06	1.02	.02
02KE002	1932	17-R	8260.0	1.07	1.02	.02
02KF010	1971	9-R	614.0	1.08	1.03	.03
02KF013	1972	11-R	280.0	1.05	1.02	.02
02LA004	1971	11-R	3830.0	1.10	1.05	.03
02LA006	1970	10-R	409.0	1.04	1.02	.01

STATISTICS OF PEAK RATIOS FOR REGION 2

STATION NUMBER (WSC)	MID START YEAR	YEARS MID USED	DRAINAGE AREA (SQ.KM)	STATISTICS MID/MD MAX	MEAN	STD
02LB005	1960	20-R	3810.0	1.11	1.04	.03
02LB007	1948	24-N	246.0	1.29	1.08	.07
02MB006	1971	7-R	80.0	1.21	1.14	.05
02LB008	1968	7-N	433.0	1.87	1.29	.28
02LB013	1976	7-R	2410.0	1.12	1.08	.04
02MC001	1969	8-N	404.0	1.17	1.08	.05

STATISTICS OF PEAK RATIOS FOR REGION 3

STATION NUMBER (WSC)	MID START YEAR	YEARS MID USED	DRAINAGE AREA (SQ.KM)	STATISTICS MID/MD MAX	MEAN	STD
02ED003	1966	17-N	1180.0	2.04	1.18	.24
02ED005	1967	15-R	295.0	3.69	1.55	.63
02ED101	1970	8-N	334.0	1.18	1.08	.05
02ED103	1970	9-N	195.0	1.58	1.20	.18
02FB003	1936	16-R	262.0	3.00	1.42	.47
02FB009	1957	24-R	572.0	1.77	1.25	.17
02FC001	1956	27-N	3960.0	1.42	1.13	.11
02FC011	1963	20-N	163.0	1.50	1.20	.14
02FC013	1972	6-R	262.0	1.53	1.30	.13
02FC015	1972	11-N	663.0	1.42	1.18	.12
02ED004	1964	13-R	207.0	1.65	1.19	.17
02ED100	1970	10-R	86.0	1.64	1.38	.19
02ED102	1970	11-N	211.0	2.13	1.41	.29
02FA001	1959	18-N	92.0	1.08	1.04	.02
02FB007	1956	18-N	181.0	1.60	1.16	.15
02FB010	1960	17-R	293.0	1.91	1.24	.19
02FC002	1952	23-N	2150.0	1.23	1.06	.05
02FC012	1972	10-R	635.0	1.53	1.18	.13
02FC014	1972	6-R	381.0	1.13	1.08	.03
02FC016	1976	6-N	329.0	2.22	1.28	.46

TABLE A15.1

STATISTICS OF PEAK RATIOS FOR REGION 4

STATION NUMBER (WSC)	MID START YEAR	YEARS MID USED	DRAINAGE AREA (SQ.KM)	STATISTICS MID/MD MAX	MEAN	STD
02FE002	1953	18-R	1630.0	1.28	1.11	.09
02FE004	1967	16-R	1760.0	1.27	1.11	.09
02FE007	1968	15-R	326.0	1.65	1.23	.16
02FE009	1968	14-N	376.0	1.60	1.24	.13
02GA003	1930	52-R	3520.0	2.16	1.29	.21
02GA013	1948	5-R	821.0	1.88	1.48	.27
02GA015	1951	24-R	593.0	1.48	1.15	.12
02GA017	1951	19-N	324.0	2.16	1.56	.30
02GA022	1953	8-R	655.0	1.44	1.22	.13
02GA024	1960	22-R	59.6	4.50	2.41	1.02
02GA029	1964	19-R	236.0	1.34	1.13	.09
02GA031	1966	17-R	44.50	1.75	1.22	.22
02GA033	1959	18-R	64.8	1.43	1.19	.12
02GA035	1971	11-N	27.7	3.86	1.98	.83
02GA037	1972	11-N	25.1	4.80	3.15	1.03
02GA039	1973	10-N	272.0	2.41	1.59	.41
02GB001	1948	31-R	210.0	1.73	1.21	.14
02GB007	1970	10-N	360.0	1.15	1.08	.04
02GB009	1973	10-N	399.0	2.29	1.80	.32
02GD001	1938	33-R	1340.0	1.47	1.19	.13
02GD004	1948	29-R	306.0	2.15	1.34	.25
02GD007	1948	5-R	1700.0	1.38	1.24	.09
02GD009	1950	22-R	140.0	2.80	1.24	.38
02GD011	1973	10-R	93.2	2.52	1.62	.45
02GD013	1974	9-N	38.9	3.91	2.03	.81
02GD015	1954	27-R	1340.0	1.79	1.29	.18
02GD018	1965	17-R	144.0	1.69	1.39	.18
02GD020	1966	16-N	108.0	2.33	1.58	.36
02FE003	1960	18-R	77.7	2.17	1.52	.28
02FE005	1963	20-R	528.0	1.71	1.25	.16
02FE008	1968	14-N	648.0	1.11	1.07	.03
02FE010	1968	11-N	197.0	1.18	1.10	.05
02GA010	1948	26-N	1030.0	2.22	1.28	.23
02GA014	1948	23-R	694.0	1.72	1.29	.20
02GA016	1952	28-R	800.0	2.00	1.25	.26
02GA018	1951	26-N	552.0	1.92	1.39	.21
02GA021	1958	25-R	118.0	2.20	1.48	.26
02GA028	1960	23-R	578.0	2.38	1.28	.35
02GA030	1966	15-R	49.7	4.75	2.15	.91
02GA032	1968	9-N	2.51	4.00	2.00	1.12
02GA034	1968	14-R	1170.0	1.97	1.37	.25
02GA036	1971	10-N	17.9	3.50	2.22	.88
02GA038	1972	10-N	326.0	2.07	1.48	.29
02GA040	1974	9-R	167.0	1.91	1.40	.30
02GB006	1959	12-R	150.0	1.48	1.23	.14
02GB008	1969	13-R	383.0	1.61	1.19	.16
02GB010	1969	10-R	171.0	1.10	1.05	.03
02GD002	1954	28-R	1450.0	1.44	1.19	.11
02GD005	1948	29-R	1080.0	1.85	1.34	.19
02GD008	1971	12-N	181.0	1.76	1.50	.17
02GD010	1966	16-N	150.0	1.65	1.33	.15
02GD012	1952	27-R	254.0	3.62	1.47	.60
02GD014	1956	16-R	319.0	2.35	1.41	.32
02GD016	1957	26-R	518.0	1.57	1.20	.15
02GD019	1967	16-N	36.0	2.11	1.55	.31

STATISTICS OF PEAK RATIOS FOR REGION 5

STATION NUMBER (WSC)	MID START YEAR	YEARS MID USED	DRAINAGE AREA (SQ.KM)	STATISTICS MID/MD MAX	MEAN	STD
02FD001	1974	9-N	154.0	2.26	1.67	.39
02FF003	1960	8-N	124.0	2.50	1.70	.47
02FF007	1967	16-N	466.0	1.57	1.26	.13
02GE002	1937	31-R	3110.0	1.34	1.15	.09
02GE005	1966	9-N	146.0	1.71	1.43	.22
02GE007	1978	5-N	202.0	1.58	1.31	.21
02GG004	1965	17-N	609.0	1.16	1.07	.05
02GG006	1967	12-N	267.0	2.12	1.53	.34
02GH001	1972	5-N	14.2	4.00	2.52	.99
02FF002	1948	20-N	865.0	1.66	1.20	.15
02FF004	1966	14-N	41.4	3.67	2.31	.87
02FF008	1973	8-N	124.0	1.81	1.30	.21
02GE003	1948	19-R	4300.0	1.06	1.02	.01
02GE006	1971	9-R	3760.0	1.06	1.03	.02
02GG002	1965	15-N	730.0	1.25	1.17	.06
02GG005	1967	16-N	172.0	1.50	1.25	.12
02GG007	1967	13-N	1240.0	1.08	1.04	.02
02GH002	1972	10-N	125.0	2.00	1.57	.29

STATISTICS OF PEAK RATIOS FOR REGION 6

STATION NUMBER (WSC)	MID START YEAR	YEARS MID USED	DRAINAGE AREA (SQ.KM)	STATISTICS MID/MD MAX	MEAN	STD
02GC002	1967	15-N	329.0	2.33	1.59	.35
02GC006	1956	22-R	363.0	1.50	1.21	.13
02GC008	1969	14-R	134.0	1.70	1.40	.18
02GC011	1964	15-R	142.0	1.73	1.36	.20
02GC013	1964	18-R	75.9	2.43	1.41	.43
02GC015	1964	18-R	104.0	1.42	1.19	.11
02GC017	1965	18-R	93.2	1.94	1.39	.26
02GC021	1967	16-R	68.4	1.57	1.14	.17
02GC023	1970	6-R	5.18	2.87	2.08	.44
02GC025	1970	5-R	10.1	1.51	1.31	0.00
02GC004	1964	12-R	697.0	1.44	1.10	.13
02GC007	1966	16-R	591.0	2.05	1.16	.27
02GC010	1961	22-N	342.0	1.40	1.16	.09
02GC012	1964	17-R	51.3	1.67	1.28	.26
02GC014	1964	14-R	65.8	2.00	1.31	.29
02GC016	1965	11-R	109.0	1.40	1.17	.10
02GC018	1965	17-N	287.0	2.03	1.49	.25
02GC022	1970	10-R	181.0	1.67	1.34	.23
02GC024	1970	8-R	27.20	1.74	1.51	.15

TABLE A15.2

STATISTICS OF PEAK RATIOS FOR REGION 7

STATION NUMBER (WSC)	MID START YEAR	YEARS MID USED	DRAINAGE AREA (SQ.KM)	STATISTICS MID/MD MAX	MEAN	STD	STATION NUMBER (WSC)	MID START YEAR	YEARS MID USED	DRAINAGE AREA (SQ.KM)	STATISTICS MID/MD MAX	MEAN	STD
02HA006	1969	14-N	293.0	1.28	1.16	.07	02HA007	1969	11-R	230.0	1.16	1.09	.05
02HA014	1978	5-N	60.9	2.31	1.89	.39	02HB004	1965	17-N	199.0	2.74	1.62	.43
02HB005	1959	23-R	95.6	2.40	1.77	.38	02HB010	1969	14-R	166.0	1.53	1.23	.12
02HB011	1964	17-R	235.0	2.22	1.34	.34	02HB012	1970	12-N	82.6	2.42	1.56	.41
02HB015	1972	11-N	63.5	1.20	1.06	.08	02HB016	1977	5-R	124.0	1.22	1.11	.09

STATISTICS OF PEAK RATIOS FOR REGION 8

STATION NUMBER (WSC)	MID START YEAR	YEARS MID USED	DRAINAGE AREA (SQ.KM)	STATISTICS MID/MD MAX	MEAN	STD	STATION NUMBER (WSC)	MID START YEAR	YEARS MID USED	DRAINAGE AREA (SQ.KM)	STATISTICS MID/MD MAX	MEAN	STD
02HB001	1967	16-R	205.0	1.32	1.18	.07	02HB002	1964	15-R	829.0	2.42	1.45	.34
02HB008	1963	20-R	127.0	4.13	1.38	.67	02HB013	1968	15-R	62.2	3.60	1.47	.62
02HC003	1948	28-R	800.0	2.08	1.37	.23	02HC005	1960	20-R	88.1	3.50	1.88	.66
02HC006	1960	17-R	249.0	4.23	1.87	.68	02HC009	1959	18-N	197.0	1.81	1.34	.21
02HC012	1965	14-R	169.0	1.85	1.32	.23	02HC013	1961	14-N	88.1	4.20	2.45	.78
02HC017	1971	12-N	63.2	2.80	1.66	.49	02HC018	1969	9-N	106.0	1.91	1.54	.28
02HC019	1964	18-N	93.5	4.35	2.04	.77	02HC022	1962	20-R	186.0	2.11	1.53	.29
02HC023	1963	19-N	62.2	2.33	1.75	.32	02HC024	1963	20-N	316.0	4.81	2.52	.83
02HC025	1963	17-N	303.0	1.73	1.35	.20	02HC026	1975	6-R	98.1	2.03	1.57	.36
02HC027	1967	16-N	58.0	7.42	3.92	1.40	02HC028	1966	14-N	77.7	1.83	1.43	.22
02HC029	1967	12-N	130.0	2.86	2.03	.46	02HC030	1967	14-N	204.0	3.28	2.02	.62
02HC031	1966	10-N	148.0	3.81	1.98	.74	02HC032	1966	15-N	94.8	1.75	1.33	.20
02HC033	1966	16-N	63.2	4.18	2.26	.75	02HC034	1966	16-R	194.0	2.23	1.40	.29
02HC035	1975	7-R	15.3	1.54	1.40	.41	02HC038	1976	7-R	52.0	1.70	1.45	.14
02HC039	1976	6-R	38.3	1.80	1.50	.20	02HC045	1975	7-N	25.9	2.14	1.94	.20
02HC046	1975	8-N	10.6	2.46	1.93	.25	02HD002	1968	14-N	262.0	2.46	1.75	.32
02HD003	1968	11-R	67.3	2.11	1.65	.27	02HD004	1968	13-R	42.7	4.95	2.29	.94
02HD006	1963	12-R	82.9	2.82	1.77	.48	02HD007	1966	10-N	77.7	4.92	2.24	1.09
02HD008	1965	15-N	95.3	3.63	2.24	.62	02HD009	1967	14-N	82.6	2.33	1.73	.35
02HD010	1967	13-N	64.8	2.67	1.76	.42							

STATISTICS OF PEAK RATIOS FOR REGION 9

STATION NUMBER (WSC)	MID START YEAR	YEARS MID USED	DRAINAGE AREA (SQ.KM)	STATISTICS MID/MD MAX	MEAN	STD	STATION NUMBER (WSC)	MID START YEAR	YEARS MID USED	DRAINAGE AREA (SQ.KM)	STATISTICS MID/MD MAX	MEAN	STD
02EC002	1975	7-N	1520.0	1.01	1.01	0.00	02EC008	1965	5-R	311.0	1.48	1.28	.14
02EC009	1966	17-N	181.0	3.36	1.69	.62	02EC010	1967	14-N	51.3	2.20	1.73	.33
02EC011	1967	12-N	282.0	1.83	1.32	.23	02EC012	1970	13-R	324.0	1.28	1.14	.09
02EC101	1971	10-R	24.3	5.00	2.13	1.19	02EC103	1970	9-N	332.0	1.14	1.05	.05
02ED007	1966	16-N	177.0	1.94	1.39	.27	02ED008	1973	10-N	95.0	1.67	1.24	.20
02ED010	1973	10-N	127.0	1.08	1.04	.04	02ED011	1974	9-N	168.0	1.38	1.19	.11
02HJ001	1970	13-N	110.0	1.43	1.12	.12	02HJ002	1971	11-R	7360.0	1.14	1.03	.04
02HJ003	1968	14-R	282.0	1.21	1.08	.06	02HK004	1965	16-R	12000.0	1.13	1.02	.03

TABLE A15.3

STATISTICS OF PEAK RATIOS FOR REGION 10

STATION NUMBER (WSC)	MID START YEAR	YEARS MID USED	DRAINAGE AREA (SQ.KM)	STATISTICS MID/MD MAX	MEAN	STD	STATION NUMBER (WSC)	MID START YEAR	YEARS MID USED	DRAINAGE AREA (SQ.KM)	STATISTICS MID/MD MAX	MEAN	STD
04JA002	1966	16-N	3780.0	1.02	1.01	.01	04JC002	1966	15-N	2410.0	1.01	1.01	0.00
04JC003	1965	18-N	3290.0	1.01	1.01	0.00	04JD005	1969	12-N	2020.0	1.02	1.01	.01
04JF001	1969	13-N	5360.0	1.01	1.00	0.00	04LA002	1969	11-R	5540.0	1.04	1.02	.01
04LQ001	1961	10-R	11900.0	1.05	1.01	.01	04LJ001	1959	24-N	8940.0	1.04	1.02	.01
04MD004	1978	5-N	401.0	1.08	1.03	.04	02BA002	1970	11-N	1190.0	1.11	1.02	.03
02BA003	1974	7-N	1320.0	1.19	1.08	.06	02B8002	1969	13-N	1980.0	1.05	1.01	.01
02B8003	1970	11-N	4270.0	1.18	1.04	.05	02BC004	1960	22-R	4170.0	1.13	1.02	.03
02BD002	1962	16-R	5130.0	1.80	1.17	.21	02BD003	1956	20-N	1930.0	1.05	1.01	.01
02BF001	1969	13-N	1190.0	1.07	1.04	.02	02BF002	1969	12-N	1160.0	1.60	1.12	.16
02BF003	1971	5-N	18.6	1.49	1.33	.14							

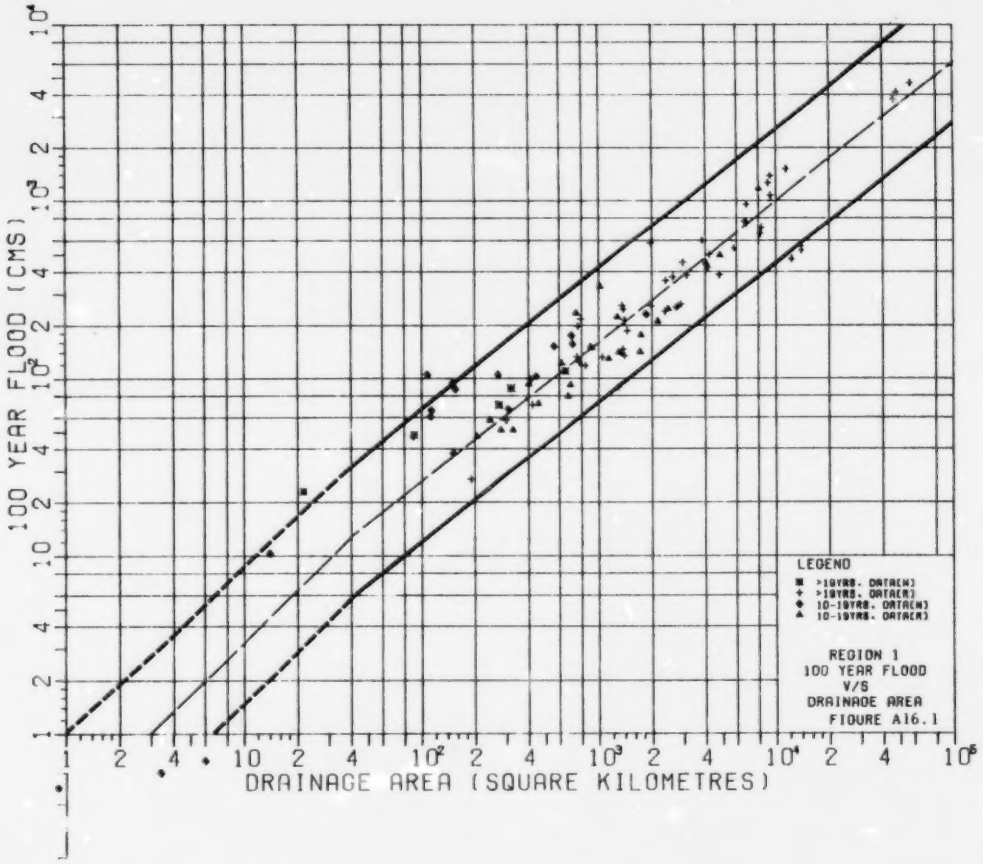
STATISTICS OF PEAK RATIOS FOR REGION 11

STATION NUMBER (WSC)	MID START YEAR	YEARS MID USED	DRAINAGE AREA (SQ.KM)	STATISTICS MID/MD MAX	MEAN	STD	STATION NUMBER (WSC)	MID START YEAR	YEARS MID USED	DRAINAGE AREA (SQ.KM)	STATISTICS MID/MD MAX	MEAN	STD
05PA006	1963	20-N	13400.0	1.03	1.01	.01	05PA012	1938	33-R	4510.0	1.32	1.02	.06
05PB014	1958	20-N	4870.0	1.03	1.01	.01	05PC011	1958	21-N	461.0	1.25	1.05	.06
05PC016	1970	8-N	243.0	1.11	1.05	.05	05PC018	1930	39-R	50200.0	1.03	1.01	.01
05PD014	1971	9-N	.58	2.80	1.42	.61	05PD017	1970	11-N	1.67	1.41	1.16	.14
05PD019	1970	11-N	.54	1.29	1.12	.09	05PD022	1971	9-N	.65	2.00	1.57	.31
05PD023	1970	10-N	3.30	1.08	1.04	.03	05PD024	1975	5-N	1.70	2.41	1.64	.50
05PD025	1975	7-N	.91	3.14	1.75	.64	05PH003	1972	6-N	3700.00	1.27	1.08	.12
05QA001	1960	14-N	13900.0	1.03	1.01	.01	05QA002	1976	5-N	6230.0	1.03	1.01	.01
05QA004	1968	14-N	4450.0	1.03	1.01	.01	05QC001	1971	6-R	4920.0	1.03	1.01	.01
05QC003	1971	12-N	2370.0	1.15	1.03	.04	05QD006	1958	21-R	6370.0	1.03	1.01	.01
05QD008	1970	11-N	.35	1.50	1.21	.16	05QD012	1971	7-N	.48	1.25	1.11	.09
05QD013	1972	7-N	.71	2.67	1.43	.59	05QD015	1972	8-N	.97	2.80	1.38	.67
05QD017	1976	7-N	2.60	1.33	1.09	.11	05QD018	1976	5-N	.97	2.00	1.20	.45
05QE008	1970	13-N	1690.0	1.17	1.02	.05	05QE009	1961	16-N	1530.0	1.06	1.01	.02
02AA001	1924	45-N	1550.0	1.22	1.07	.05	02AA002	1973	5-N	389.0	1.77	1.32	.28
02AB006	1967	14-R	6480.0	1.12	1.04	.04	02AB008	1954	17-N	187.0	1.51	1.16	.13
02AB009	1971	11-R	2800.0	1.06	1.03	.02	02AC001	1971	12-N	736.0	1.09	1.04	.02
02AC002	1971	10-R	2980.0	1.05	1.02	.02	02AD010	1973	9-N	650.0	1.02	1.00	.01
02AE001	1975	8-N	616.0	1.42	1.07	.14	04CA002	1970	11-N	36500.0	1.04	1.01	.01
04CA003	1970	12-N	619.0	1.05	1.02	.02	04CA004	1968	10-N	3500.0	1.04	1.01	.02
04CB001	1968	14-N	10800.0	1.07	1.01	.02	04CD002	1971	11-N	4270.0	1.04	1.02	.02
04CF002	1969	14-N	4350.0	1.06	1.02	.01	04DA001	1969	14-N	5960.0	1.01	1.00	0.00
04DA002	1970	8-N	19000.0	1.03	1.01	.01	04DB001	1969	10-N	7950.0	1.02	1.01	.01
04DB002	1969	7-N	3240.0	1.02	1.01	.01	04DC002	1972	8-N	4710.0	1.04	1.01	.01
04EA001	1970	8-N	10400.0	1.34	1.05	.12	04FA001	1969	13-R	9010.0	1.03	1.01	.01
04FA002	1969	14-R	1540.0	1.02	1.00	.01	04FA003	1969	10-N	4900.0	1.01	1.00	0.00
04FB001	1968	8-N	24200.0	1.00	1.00	0.00	04GA002	1971	11-N	5390.0	1.02	1.01	.01
04GB004	1972	19-N	11200.0	1.12	1.02	.04	04GB005	1977	6-N	1170.0	1.07	1.04	.03
04GC002	1974	7-R	16300.0	1.03	1.01	.01	04GD001	1969	13-R	32400.0	1.01	1.00	0.00
04HA001	1965	12-R	118000.0	1.11	1.02	.04							

STATISTICS OF PEAK RATIOS FOR REGION 12

STATION NUMBER (WSC)	MID START YEAR	YEARS MID USED	DRAINAGE AREA (SQ.KM)	STATISTICS MID/MD MAX	MEAN	STD	STATION NUMBER (WSC)	MID START YEAR	YEARS MID USED	DRAINAGE AREA (SQ.KM)	STATISTICS MID/MD MAX	MEAN	STD
04JG001	1969	8-R	26200.0	1.01	1.01	.01	04KA001	1973	8-N	4250.0	1.09	1.04	.03
04LG002	1960	22-R	61100.0	1.10	1.02	.03	04LM001	1973	6-N	22900.0	1.03	1.02	.01
04ME003	1961	15-R	27500.0	1.39	1.09	.11	04MF001	1969	9-N	6680.0	1.09	1.04	.03

TABLE A15.4


100 YEAR FLOOD (CMS)
DRAINAGE AREA (SQUARE KILOMETRES)
LEGEND
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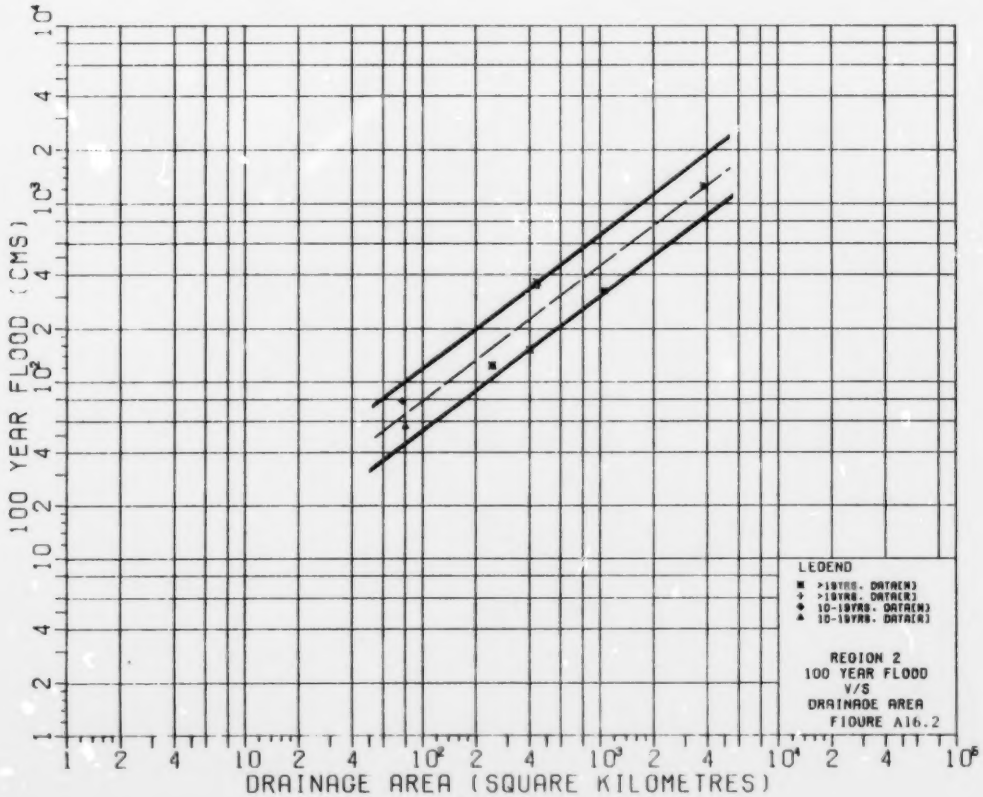
>10YRS. DATA(R)
10-10YRS. DATA(N)
10-10YRS. DATA(R)
REGION 1
100 YEAR FLOOD
V/S
DRAINAGE AREA
FIGURE A16.1


100 YEAR FLOOD (CMS)
DRAINAGE AREA (SQUARE KILOMETRES)
LEGEND
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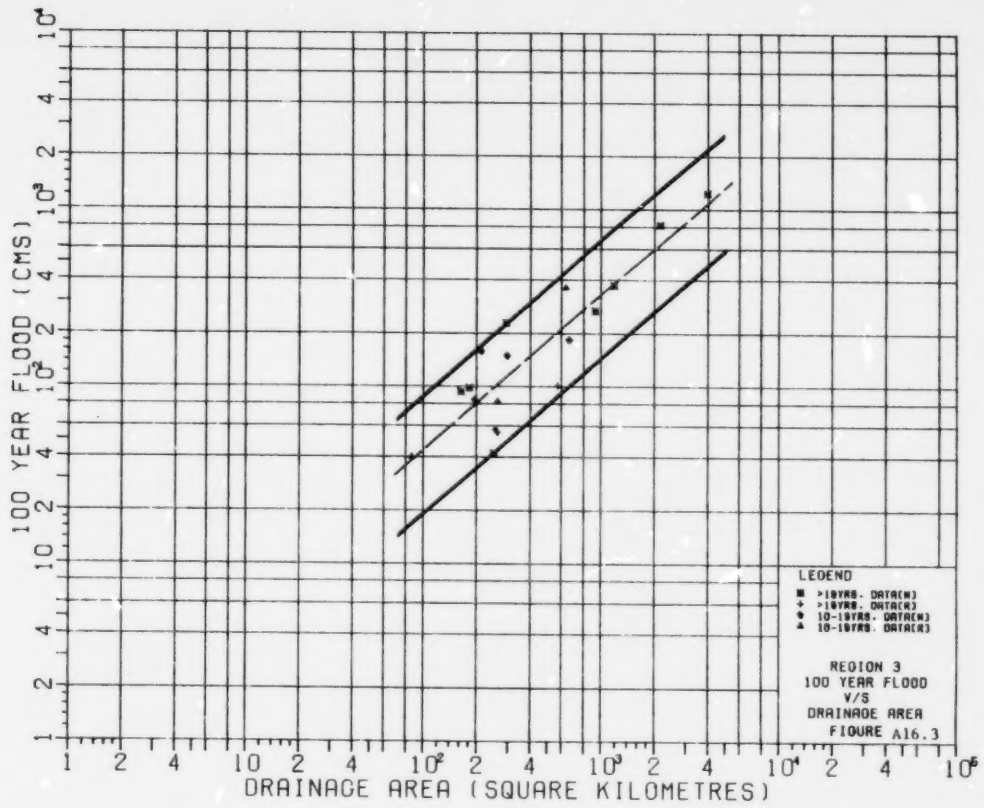
>10YRS. DATA(R)
10-10YRS. DATA(N)
10-10YRS. DATA(R)
REGION 2
100 YEAR FLOOD
V/S
DRAINAGE AREA
FIGURE A16.2


100 YEAR FLOOD (CMS)
DRAINAGE AREA (SQUARE KILOMETRES)
LEGEND
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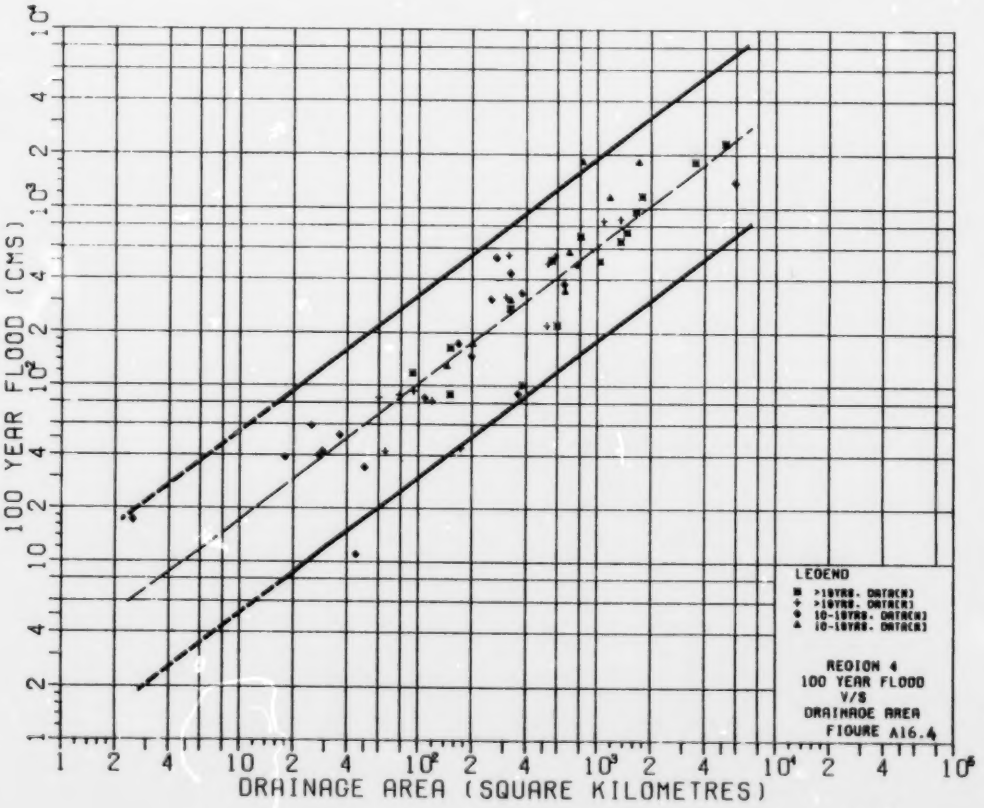
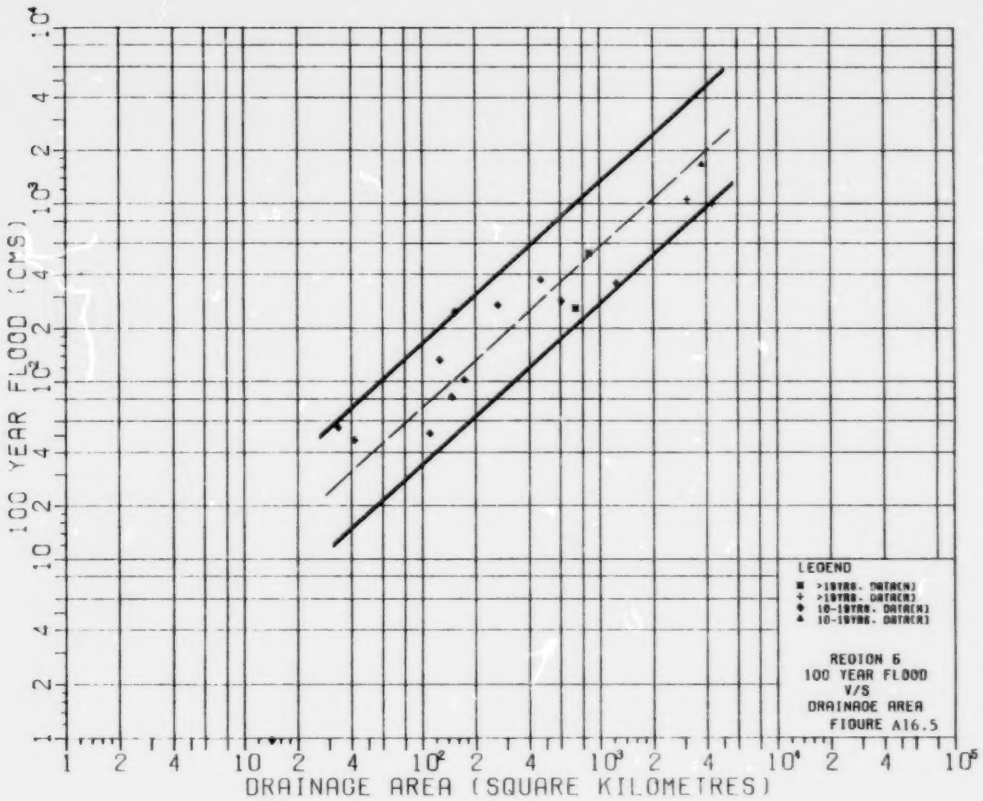
>10YRS. DATA(R)
10-10YRS. DATA(M)
10-10YRS. DATA(R)
REGION 3
100 YEAR FLOOD
V/S
DRAINAGE AREA
FIGURE A16.3


100 YEAR FLOOD (CMS)
DRAINAGE AREA (SQUARE KILOMETRES)
LEGEND
>10YRS. DATA(M)
>10YRS. DATA(R)
10-10YRS. DATA(M)
10-10YRS. DATA(R)
REGION 4
100 YEAR FLOOD
V/S
DRAINAGE AREA
FIGURE A16.4


100 YEAR FLOOD (CMS)
DRAINAGE AREA (SQUARE KILOMETRES)
LEGEND
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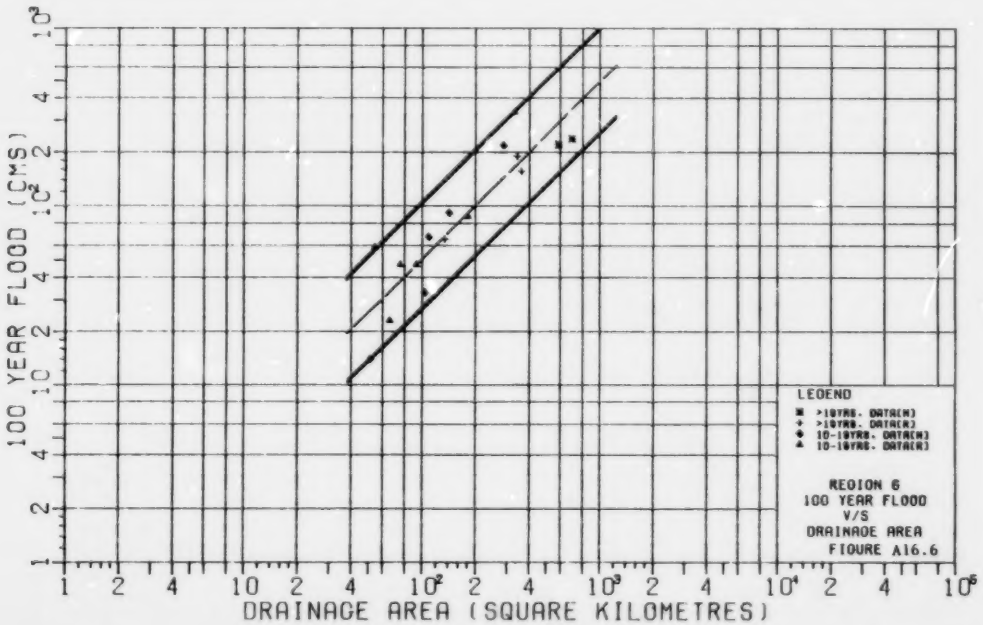
>10YRS. DATA(R)
10-10YRS. DATA(N)
10-10YRS. DATA(R)
REGION 6
100 YEAR FLOOD
V/S
DRAINAGE AREA
FIGURE A16.5


100 YEAR FLOOD (CMS)
DRAINAGE AREA (SQUARE KILOMETRES)
LEGEND
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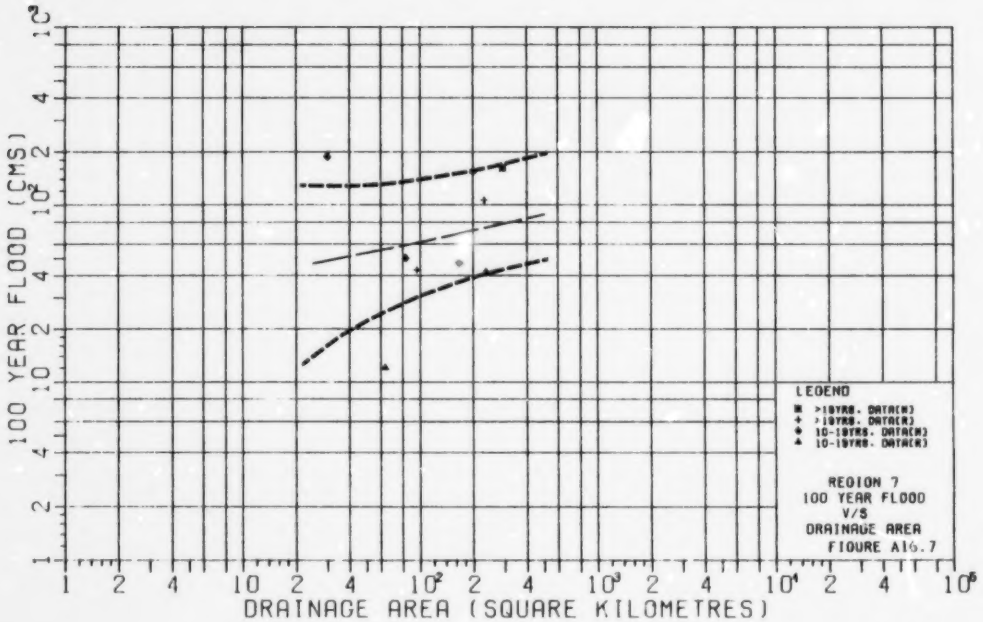
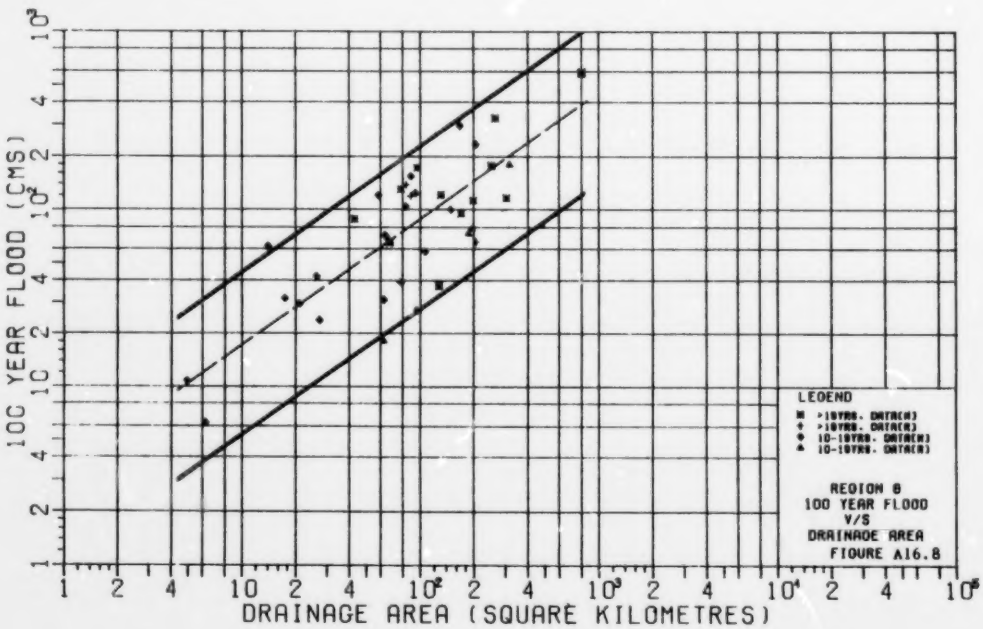
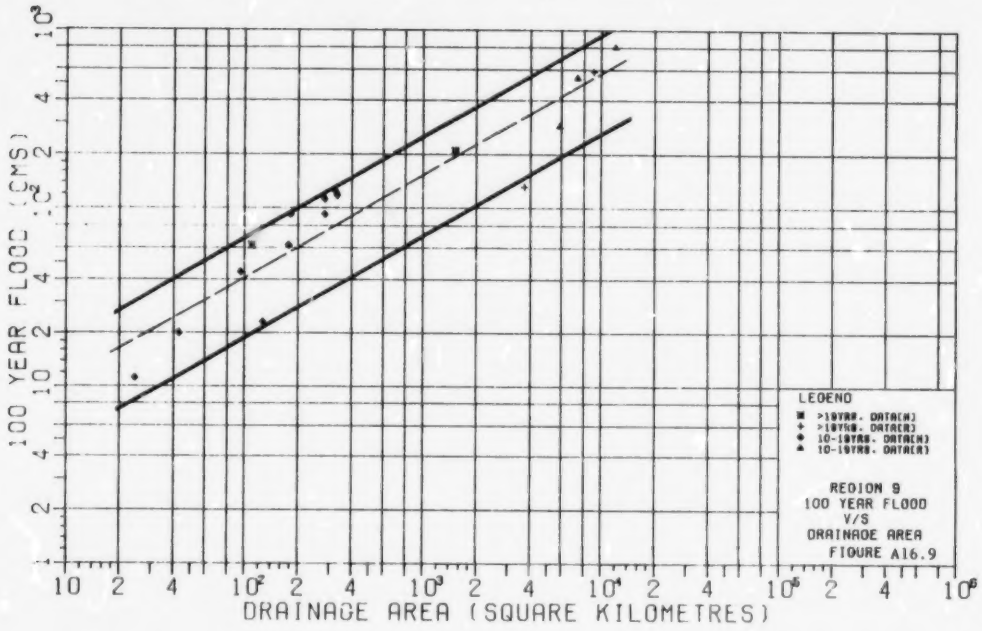
>10YRS. DATA(R)
10-10YRS. DATA(N)
10-10YRS. DATA(R)
REGION 6
100 YEAR FLOOD
V/S
DRAINAGE AREA
FIGURE A16.6


100 YEAR FLOOD (CMS)
DRAINAGE AREA (SQUARE KILOMETRES)
LEGEND
REGION 7
100 YEAR FLOOD
V/S
DRAINAGE AREA
FIGURE A16.7


100 YEAR FLOOD (CMS)
DRAINAGE AREA (SQUARE KILOMETRES)
LEGEND
REGION 8
100 YEAR FLOOD
V/S
DRAINAGE AREA
FIGURE A16.8


100 YEAR FLOOD (CMS)
DRAINAGE AREA (SQUARE KILOMETRES)
LEGEND
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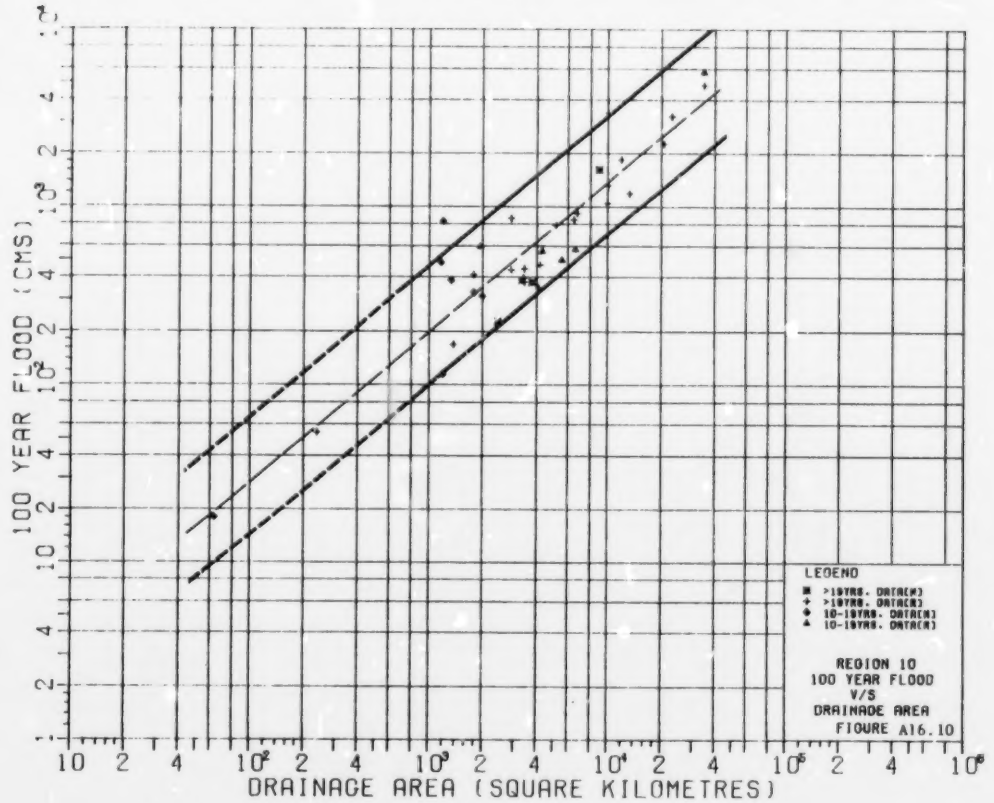
>10YRS. DATA(R)
10-10YRS. DATA(M)
10-10YRS. DATA(R)
REGION 9
100 YEAR FLOOD
V/S
DRAINAGE AREA
FIGURE A16.9


100 YEAR FLOOD (CMS)
DRAINAGE AREA (SQUARE KILOMETRES)
LEGEND
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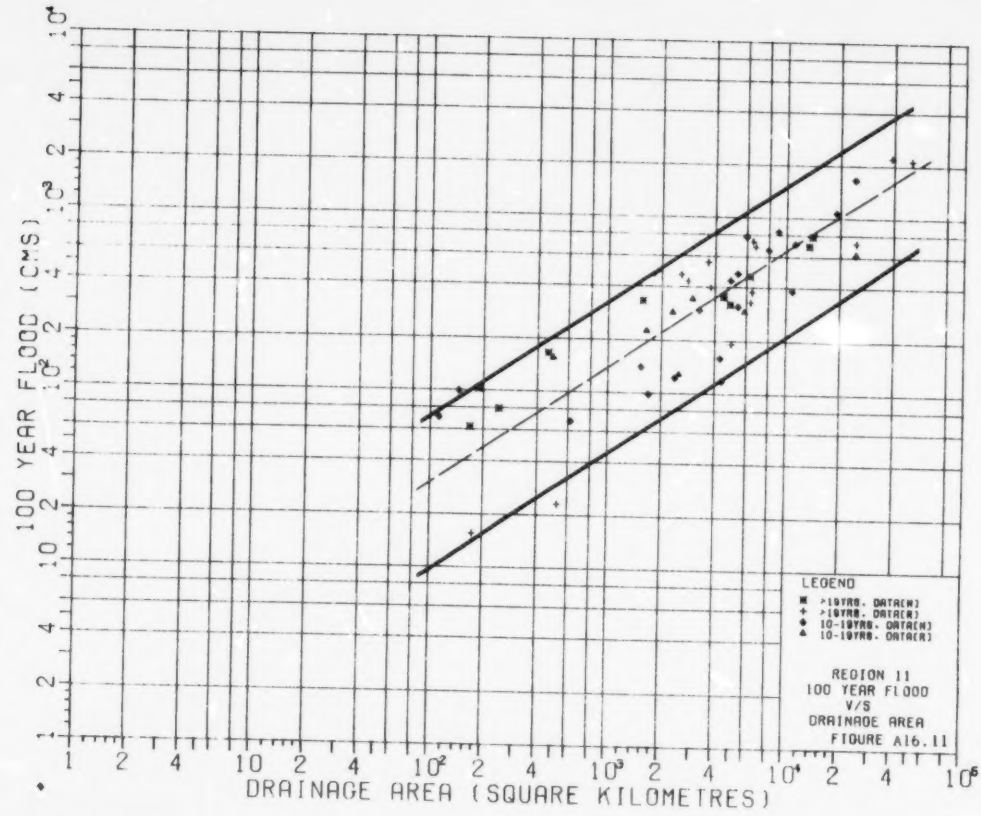
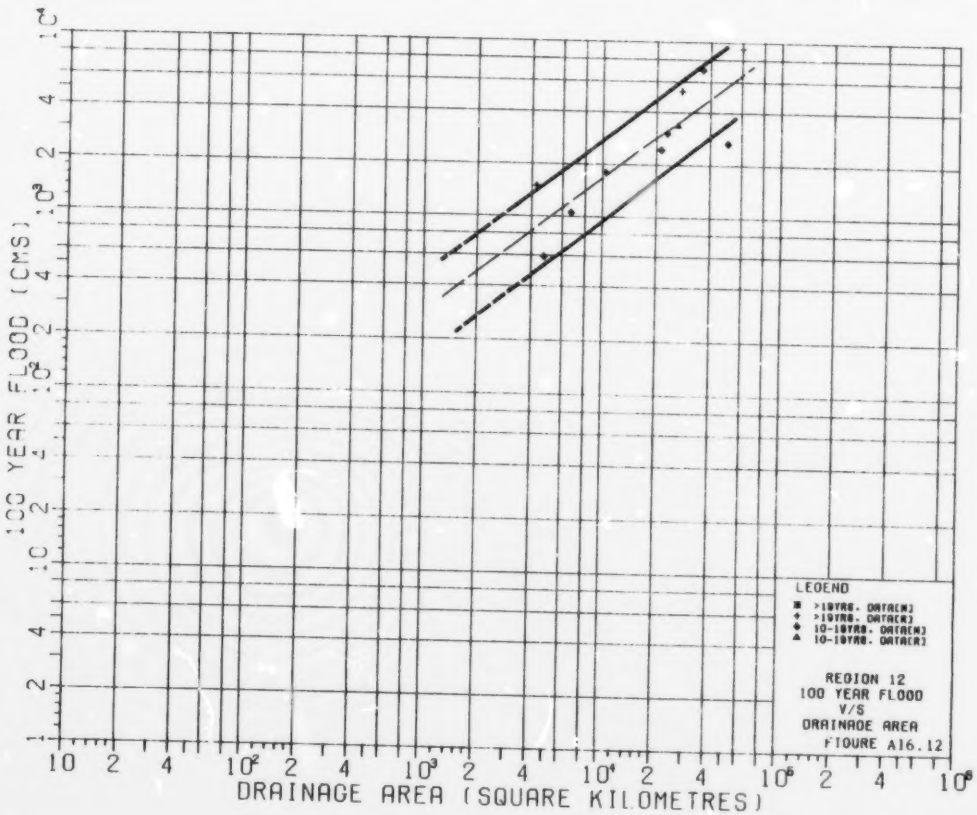
>10YRS. DATA(R)
10-10YRS. DATA(M)
10-10YRS. DATA(R)
REGION 10
100 YEAR FLOOD
V/S
DRAINAGE AREA
FIGURE A16.10


100 YEAR FLOOD (CMS)
DRAINAGE AREA (SQUARE KILOMETRES)
LEGEND
REGION 11
100 YEAR FLOOD
V/S
DRAINAGE AREA
FIGURE A16.11


100 YEAR FLOOD (CMS)
DRAINAGE AREA (SQUARE KILOMETRES)
LEGEND
REGION 12
100 YEAR FLOOD
V/S
DRAINAGE AREA
FIGURE A16.12

APPENDIX B

APPENDIX B

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APPENDIX B

FLOOD FREQUENCY REGIONS

The following and the descriptions for Regions 1 through 9 are based on a previous study by Sangal and Kallio (1977):

The selection of regions with similar hydrologic characteristics was based primarily on physiographic characteristics and the nature of the surficial soils. Some consideration was also given to climatic conditions and land use. Regional boundaries were delineated to include whole drainage basins. There were a few exceptions which are noted below in the brief descriptions of each region. The analysis of data on mean annual flood played an important role in the final selection of boundaries for various regions.

Twelve flood frequency regions were delineated. The complex physiography and lack of adequate streamflow records in some areas of Ontario made this delineation extremely difficult. Hence, there is a strong element of judgment in the selection of regional boundaries as shown on Figure 5.1.1.

A brief description of each of the selected regions follows. Physiographic and soils information for the purposes of regionalization was based mainly on the work of Chapman and Putnam (1966), the Ontario Soil Survey, Hoffman et al. (1984), and Geological Survey of Canada Publications (Ref. 20, 21). Data on river gradients and general watershed characteristics were obtained from the appropriate conservation authority reports and other hydrologic studies published by the Conservation Authorities Branch, Ministry of Natural Resources, Government of Ontario (OMNR), and from watershed physiographic data extracted by the study team and other consultants retained by the OMNR for the Multiple Regression Analysis component of the study. Climatic data were taken mainly from Brown et al. (1968).

REGION 1 - Canadian Shield, Southern Ontario

Region 1 is the area of the Canadian Shield from the contact line with the glacially deposited sands and gravels, essentially along the Trent and Severn Rivers, west to the outlet of Lake Superior, north to the northern drainage divide to the Hudson Bay and east to the watershed boundary of the Rideau River. This is a region of glacially scoured Precambrian rocks, rugged relief and forested lands. The soils are generally coarse textured and formed on coarse stony till, sand and gravel. Generally, the bedrock is located at a depth of 0.3 m or less. Deeper soil has been mapped in the southeast sector of this region and classified into the Osprey, Tweed and Monteagle groups of loams and sandy loams.

Numerous lakes were gouged by the glaciers resulting in a relatively large amount of storage along the major river systems. The limestone plains in eastern Ontario near Napanee and Smiths Falls are included in this region. Most of the streams traversing the limestone plains rise on the Canadian Shield. The smaller streams originating on the limestone plains may not be typical of this region. A similar note should be made for the Prince Edward Peninsula. Most of the peninsula is a limestone plateau with shallow soils. Not enough streamflow data are available to develop regional frequency relationships for this area.

The mean stream slope (weighted) derived from data for 54 stations in the region was 1.39 m per km with a standard deviation of 1.18 m per km. These slopes ranged from 0.02 m per km for the South Branch of the Muskoka River (at Bayville) to 5.77 m per km for the Root River (at Sault Ste. Marie).

The range of mean annual precipitation is the largest for any of the regions. A maximum of more than 1016 mm (40 in.) falls in the lee of Georgian Bay. Mean annual snowfall is greater than 285 cm (112 in.) in the same area. Annual snowfall on a large portion of the Shield is about 203 cm (80 in.). Annual precipitation near Pembroke is about 660 mm (26 in.), increasing to about 864 mm (34 in.) towards the southern sections of the region.

The lowest temperatures in southern Ontario are recorded in the Algonquin Park Uplands. Mean annual temperatures vary from approximately 3.9°C (39°F) in Algonquin Park to more than 6.7°C (44°F) near Lake Ontario.

The median values for the parameters of 95 (30) stations analysed which are influenced by the regional characteristics described in the foregoing are as follows:

Specific 2 Year Flood (Q2 /A)	0.07 (.12) m^3/s per sq km
Mean annual Runoff (MAR)	414 (410) mm
Base Flow Index (BFI)	0.66 (.50)

( ) denotes data for heavily regulated stations not included.

REGION 2 - St. Lawrence Lowlands

Region 2 comprises the farmlands of the St. Lawrence Lowlands. The processes of glaciation and deglaciation by the Wisconsin ice sheet have created the present complex composition of surface deposits. Till and sand plains, drumlin fields, till, sand and gravel ridges were deposited by glaciers. During the ice recession, an arm of the sea extended up the lower Ottawa Valley and large areas of lacustrine deposits of silts and clays were laid. Clay flats were also formed in the hollows between intervening ridges. In Carleton, Prescott and Russell counties, there are a group of sand plains that were deltaic deposits of the Ottawa River and its north bank tributaries. There is generally a lack of relief throughout this region. Consequently drainage is poor and swamps and bogs are common. The poor drainage is reflected in the major soil groups mapped in the region. For the coarse- and medium-textured soils, the Rubicon and Granby groups of sandy loams are the most important. On well drained stony tills, the most important group is the Grenville loam. The Brookston and Elderslie clay loams are found on till and lacustrine sediments and are fine-textured soils with imperfect drainage. The fine-grained clays of the lower Ottawa Valley are mainly classed as the Lincoln family of clays. Drainage is again poor for this group.

Because of the extent of fine-grained soils and lack of relief, the rivers are characteristically muddy and sluggish.

The mean stream slope (weighted) derived from data for 7 stations in the region was 1.34 m per km with a standard deviation of 1.15 m per km. These slopes ranged from 0.14 m per km for the South Nation River (near Plantaganet Springs) to 1.09 m per km for the East Branch of the Scotch River (near St. Isidore De Prescott).

The region is mainly bounded by the 5.6°C (42°F) and 6.7°C (44°F) isotherms of mean annual temperature. Average annual snowfall increases from about 203 to 244 cm (80 to 96 in.) from west to east and average precipitation from 813 to 914 mm (32 to 36 in.).

The rivers of this region have cut only shallow valleys because of low gradients. With the high snowfalls and cold winter temperatures, annual spring flooding is a recurring problem in the St. Lawrence Lowlands.

The median values for the parameters of 8 (7) stations analysed which are influenced by the regional characteristics described in the foregoing are as follows:

Specific Mean Annual Flood (Q2 /A)	0.25 (.23) m^3/s per sq km
Mean Annual Runoff (MAR)	427 (420) mm
Base Flow Index (BFI)	0.30 (.30)

( ) denotes data for heavily regulated stations not included.

REGION 3 - Saugeen-Nottawasaga System

This region extends from the Saugeen River east to the Nottawasaga River and includes the smaller streams flowing north to Georgian Bay. The streams drain part of the Dundalk till plain and the border of the Niagara Cuesta, some of the highest land in southwestern Ontario.

Region 3 is a complex of till ridges, kame moraines, outwash plains, smoothly moulded till plains and drumlinized areas. Inter-drumlin areas and the hollows on till plains are characterized by swamps or bogs. The soils of the region are mainly formed from medium- to coarse-textured materials. Consequently, permeability is high in the region. Soils with good drainage having medium and coarse texture have been mapped into the Guelph, Fox, Dumfries and Osprey families of loams and sandy loams. The London group loam occurs in instances of imperfect drainage. Fox, Guelph and Tioga families have formed on the coarse sands and gravels.

The average gradients of the streams draining the escarpment are fairly large. For some of the main rivers, the average gradients in m per km are: Beaver River, 3.17, Bighead River, 2.34, Nottawasaga River, 1.58, Pine River, 3.77, and Mad River, 2.98. Slopes are much greater as the rivers descend the escarpment, often being in the order of 12 m per km or more. The average slopes for the Saugeen River System are also high, the average for the main river being 2.10 m per km. Headwater streams have gradients in the range of 1.18 to 4.12 m per km. The Saugeen Basin is somewhat characteristic of the region's river basins. In the headwaters, there is much rough stony land with a great local relief among the kames and drumlins. Thirty to thirty-five percent of the farmlands are in woods and swamp. Because of the high proportion of pervious soils, strong base flows are maintained during summer and the Saugeen flows clear even after strong summer storms. Incidentally, Ontario's finest trout streams are in this region.

The mean stream slope (weighted) derived from data for 17 stations in the region was 2.22 m per km with a standard deviation of 1.27 m per km. These slopes ranged from 0.66 m per km for the North Saugeen River (near Paisley) to 5.24 m per km for the Boyne River (at Earl Rowe Park).

Being in the lee of Lake Huron, the Dundalk Uplands experience a high average annual precipitation. It increases from around 813 mm (32 in.) near the lakeshore to more than 1016 mm (40 in.) in the highest part of the upland. Average annual snowfall is about 285 cm (112 in.). The decrease in mean annual temperature is from approximately 6.7°C (44°F) along the coast of the lake to less than 5.6°C (42°F) on the Dundalk Upland.

The depth of overburden on the Bruce Peninsula is not great. It is essentially a limestone plain with a few scattered sand and gravel deposits. Regional flood frequency relationships developed for Region 3 may not be applicable to the peninsula; however, not enough data were available to develop separate relationships. Similarly, the regional relationships may not be applicable to the eastern tributaries of the Nottawasaga River in the vicinity of the Lake Simcoe Lowlands. The slopes are much flatter in the lowlands and are not typical of most rivers of this region.

The median values for the parameters of 18(15) stations analysed which are influenced by the regional characteristics described in the foregoing are as follows:

Specific 2 Year Flood (Q2 /A)	0.14 (.14) m^3/s per sq. km
Mean Annual Runoff (MAR)	445 (446) mm
Base Flow Index (BFI)	0.62 (.61)

( ) denotes data for heavily regulated stations not included.

REGION 4 - Maitland-Thames-Grand System

The Maitland, Thames and Grand River Basins are grouped to form Region 4. Although somewhat similar to Region 3, this region contains less woodland, swamp and rough stony land. There are larger areas of till and clay plain and cleared farmland. The Bayfield River Basin is similar to that of the Maitland and has therefore been included in this region.

The Maitland and Grand Rivers rise on the Dundalk Till Plain, the "roof" of southwestern Ontario. The Stratford Till Plain, basically silty clay with a faint knoll and sag relief, is also drained by the rivers of this region, though drainage is mainly by way of the Thames System.

The difficulties of regionalization presented by the variability of the surficial soils and physiography in southern Ontario are well exemplified within the basins of the rivers of this region. This variability is apparent even within a single river basin. In the Grand Basin, the upper western tributaries such as the Nith and the Conestoga rise on a cleared clay plain. Because of the clay soil, the permeability is low and runoff rapid. Consequently, rivers such as the Conestoga yield high floods and low summer flows. The Speed and Eramosa Rivers are eastern tributaries and have less variable flow. They drain the main part of the Guelph Drumlin Field and the Paris Moraine above Guelph. Within the area, soil materials are the stony tills of the drumlins, the deep gravel terraces of the old spillways and the coarse gravels of the moraine. Guelph and Dumfries families of loams are the most important soils mapped for the area. Coarse-textured soils formed on till and sand and gravel are also prevalent in the mid-reaches of the Grand River Basin. The Guelph and Dumfries families are widely mapped along with the Fox sandy loams. The area of fine sandy loam east of Brantford is identified as the Honeywood group. The till plains covering the Conestoga, Nith and Upper Thames River Basins are poorly drained clay loams of the Perth and Brookston families and the well drained Huron clay loam. Silty deposits in northern Oxford and Western Middlesex Counties have been designated as silty alluvial deposits over a loam till. This area contains predominantly Honeywood and Tuscola silt loam.

Generally, the river gradients in this region are moderate. The overall slope of the Maitland River is 0.91 m per km, averaging 1.18 m per km for the main headwater tributaries. The Maitland is unusual because slopes are high on the headwaters, low in the mid-reaches, then increase in the lower section. Below London, the Thames River has an average fall of approximately 0.24 m per km. The north branch falls an average of 0.82 m per km, while the middle and south branches fall about 1.29 m per km. These slopes are somewhat uniform over the stream lengths. On the Grand River, the gradient averages 1.0 m per km above Brantford and 0.24 m per km below. The gradients for the Conestoga and Nith Rivers are 1.27 and 0.78 m per km, respectively. The gradients for the Speed and Eramosa Rivers reflect the topography and average 1.81 and 1.93 m per km, respectively (Grand River Conservation Authority, 1966).

The mean stream slope (weighted) derived from data for 52 stations in the region was 2.09 m per km with a standard deviation of 1.52 m per km. These slopes ranged from 0.63 m per km for the McKenzie Creek (near Caledonia) to 7.97 m per km for the Grand River (at Conestoga).

Mean annual precipitation increases from the southern part of the region near Lake Erie to the northern sections from approximately 864 mm (34 in.) to more than 1016 mm (40 in.); again the maximum is in the Dundalk Upland. Mean annual snowfall increases from less than 152 cm (60 in.) to a maximum of 305 to 330 cm (120 to 130 in.). Therefore, the proportion of snowfall of the total precipitation increases toward the Dundalk Plain. Mean annual temperatures range from about 9°C (48°F) in the Lower Grand Basin to less than 5.6°C (42°F) in the headwaters.

The median values for the parameters of 55 (47) stations analysed which are influenced by the regional characteristics described in the foregoing are as follows:

Specific 2 Year Flood (Q2 /A)	0.28 (.28) m^3/s per sq. km
Mean Annual Runoff (MAR)	356 (354) mm
Base Flow Index (BFI)	0.37 (.36)

( ) denotes data for heavily regulated stations not included.

REGION 5 - Lake St. Clair

The basins of the rivers draining the clay plains adjacent to Lakes Huron and St. Clair are grouped to form this region. Included in this region is a strip along Lake Huron, termed the Huron Slope by Chapman and Putnam (1966) that is essentially a clay plain. Streams such as the Pine, Eighteen Mile and Penetangore flow across the aforementioned plain. The lower main stems of the Thames and Maitland Rivers are in this region, but the relationships for this region are not applicable to these lower river courses.

The Lake St. Clair Region is basically a till plain levelled with shallow deposits of clay. The surface is gently undulating or has a faint knoll and sag relief. The plains are irregularly broken by sand and gravel or clay till ridges. Shallow sand plains exist in the Lower Thames Valley. These are former deltaic deposits of the Thames and are spread somewhat evenly over the clay floor to depths of 0.7 m or less. The soils of the till plain in the inland section of the region are clay loams of the Huron, Perth and Brookston families. Lincoln and Haldimand clay families have been mapped on the lands adjacent to the St. Clair River. Most of the soil of the clay plain of Essex County has been classified as Brookston clay loam. The strip along Lake Huron that has been included in this region is also basically a till plain of a brown calcareous till with shallow clay deposits superimposed. Overlying the clay in some scattered locations are shallow deltaic and beach deposits of fine sands and silts. Clay loams of the Huron, Perth and Brookston families are the most frequent soils on the fine-grained materials. On the aforementioned sandy soils, sandy loams of the Berrien and Burford groups are more numerous.

High rates of runoff are characteristic in this region due to the impervious clay plains. Headwater streams, many of them now drainage ditches, are often completely dry in summer. The proportion of land cleared for farming is greater than the average for southern Ontario.

The clay plains have little relief, a fact reflected in river gradients. Average gradient for Bear Creek and Sydenham River is 0.41 m per km, while gradients in the upstream are of the order of 1.18 m per km or more. Slopes for the Ausable River and Parkhill Creek average 0.33 and 0.80 m per km, respectively.

The mean stream slope (weighted) derived from data for 17 stations in the region was 1.27 m per km with a standard deviation of 1.07 m per km. These slopes ranged from 0.21 m per km for the Thames River (nead Dutton) to 3.66 m per km for the Pine River (at Lurgan).

Mean annual precipitation varies from 762 mm (30 in.) in the southwest peninsula to 864 mm (35 in.) in the northern section along the shore of Lake Huron. Mean annual snowfall increases from less than 127 cm (50 in.) in the southwest to approximately 254 cm (100 in.) in the northern section. In the two southernmost counties, Kent and Essex, snow does not remain on the ground for any appreciable length of time. Apart from these counties, the ground is usually covered during January and February. The range of mean annual temperature is from 6.7°C (44°F) in the north to more than 9°C (48°F) in the south.

The median values for the parameters of 17 (17) stations analysed which are influenced by the regional characteristics described in the foregoing are as follows:

Specific Mean Annual Flood (Q2 /A)	0.24 m^3/s per sq km
Mean Annual Runoff (MAR)	365 mm
Base Flow Index (BFI)	0.33

( ) denotes data for heavily regulated stations not included.

REGION 6 - Lake Erie

The tobacco-growing lands on the north slope of Lake Erie are in Region 6. This region encompasses several short streams draining into Lake Erie and is bounded by the watershed divide of the Grand River in the east and north and Rondeau in the west.

The divide between the Thames River and the Lake Erie tributaries is a succession of ridges composed of a silty clay or clay till. The major streams of the region such as Kettle, Catfish, Otter and Big Creek rise on this area of ridges. The ridges diminish towards the west and the drainage divide between lakes Erie and St. Clair is not often definite. The streams then flow across clay plain and sand plain and have cut fairly deep steep-sided valleys.

The sand plains of the tobacco-growing lands were deltaic deposits in a former glacial lake. The sand deposits may be up to 23 m deep, but are usually less than 9 m deep. The clay plains are composed of clay till with a varying depth of lacustrine silt and clay superimposed. The most important soils of the ridges are Huron clay or silt loam on the well drained sections, and the Perth series of silt loams in the poorly drained hollows. On the gently undulating clay plains, the most important groups mapped are the Haldimand and Lincoln clays.

Flood frequency relations are complicated by the differences in permeability of the surficial soils. For example, in the Big Creek drainage area, 74 per cent of the soils have been classed as pervious, 23 per cent semipervious and 3 per cent as impervious (Big Creek Region Conservation Report, 1958). For the purposes of the three classifications of permeability, sand plains, beaches and shorecliffs were defined as pervious, till plains and moraines as semipervious, and clay plains, bogs and marshes as almost impervious. Some tributaries, North Creek for example, flow almost entirely on sand plains. Consequently, 97 percent of the North Creek basin soils are classed as pervious and 3 per cent as semipervious. Nanticoke Creek in the eastern end has 40 per cent pervious soils, 14 per cent semipervious and 46 per cent almost impervious.

Average stream slopes in the region are moderately high. For some of the main rivers, average gradients in metres per kilometer listed in the appropriate conservation reports are: Kettle Creek, 0.89; Otter Creek, 0.96; Little Otter Creek, 1.94; Big Creek, 0.91; Lynn Creek, 1.53; and Nanticoke Creek, 0.89. Much greater slopes, varying from 2 to 7 m per km occur in the headwaters.

The mean stream slope (weighted) derived from data for 17 stations in the region was 1.57 m per km with a standard deviation of 0.71 m per km. These slopes ranged from 0.56 m per km for the Big Creek (near Walsingham) to 2.96 m per km for the North Creek (at Delhi).

The average annual precipitation in the Big Creek Basin is about 864 mm (34 in.) and snowfall is about 137 cm (54 in.) (Big Creek Conservation Report, 1958). The proximity of Lake Erie has a moderating effect on the climate. The mean annual temperature for the Lake Erie counties is about 8.4°C (47°F).

The median values for the parameters of 16 (14) stations analysed which are influenced by the regional characteristics described in the foregoing are as follows:

Specific Mean Annual Flood (Q2 /A)	0.13 (.13) m^3/s per sq km
Mean Annual Runoff (MAR)	369 (372) mm
Base Flow Index (BFI)	0.60 (.60)

( ) denotes data for heavily regulated stations not included.

REGION 7 - Niagara Peninsula

The rivers draining the Haldimand clay plain of the Niagara Peninsula were placed in Region 7. The region extends up to the divide between Oakville Creek and the Credit River. Streams such as Oakville Creek have been included because, although their source area is the Niagara Cuesta, they drain clay and till plains, notably the Peel and Iroquois Plains.

The peninsula was formerly covered by glacial Lake Warren. Not all of the area though, is buried by stratified clay. There are morainic ridges in the north the provide the only real relief on the clay plain. The southern part has more the characteristics of a typical level lake plain. The fine-grained parent materials and poor drainage have produced the Haldimand and Lincoln series of clays. Haldimand clay has been mapped as far as the Credit River Basin.

The main feature of the area is, of course, the Niagara Escarpment. The climatic advantage presented by the presence of the escarpment has enabled the plain between the scarp and Lake Ontario to become an important fruit-growing area.

Most of the streams originate near the morainic hills in the north and flow across the clay plain until captured to flow down the escarpment in deep steep-sided valleys. The Welland River used to empty into the Niagara River, but is now part of the Chippewa-Queenston Power Canal. No streams of any consequence in this region drain into Lake Erie. The clay plains produce high rates of runoff and have low slopes. The average gradient of the Welland River above the power canal is 0.35 m per km, and for Twenty Mile Creek, on the clay plain, 0.56 m per km.

The main stream slope (weighted) derived from data for 8 stations in the region was 2.03 m per km with a standard deviation of 1.01 m per km. These slopes ranged from 0.55 m per km for the Welland River (below Caistor Corners) to 3.36 m per km for the Oakville Creek (at Milton).

The peninsula is part of the Lake Erie Counties climatic region. Mean annual temperature in the region is about 8.4°C (47°F). Mean annual precipitation is approximately 864 mm (34 in.), including snowfall of about 127 cm (54 in.).

The median values for the parameters of 9 (6) stations analysed which are influenced by the regional characteristics described in the foregoing are as follows:

Specific Mean Annual Flood [Q2 /A]	0.21 (.27) m^3/s per sq km
Mean Annual Runoff (MAR)	345 (323) mm
Base Flow Index (BFI)	0.45 (.36)

( ) denotes data for heavily regulated stations not included.

REGION 8 - Lake Ontario

The drainage divide along the crest of the Oak Ridges Moraine forms the boundary between Regions 8 and 9. The north slope streams of the moraine are tributary to the Trent-Severn River System and the south slopes drain to Lake Ontario. From west to east, this region encompasses the basins from the Credit River to the divide between the streams that flow in Lake Ontario and those that flow into the Trent River.

The source for most of the streams is the Interlobate Moraine. The water drains vertically through the pervious soils, mostly sands and gravels, and appears as springs along the slopes. Just south of the moraine is a sloping till plain containing a variety of soils, sandy in the east and more clayey in the west. In the west, the Peel clay plain breaks the till plain into two arms. The soils are dominantly medium- and coarse-textured and are formed on till, or sand and gravel. On the hilly topography, the sandy loam is of the Fox and Guelph series. A large section of the till plain is Guelph loam, with London series loam in imperfectly drained sections. The sandy areas of the till plain are classed as Bookton, Fox and Honeywood sandy loams.

For some streams, the source area is the morainal deposits on the Niagara Cuesta. This is the case for the Credit River. Others, such as the Don River, Etobicoke and Highland Creeks, drain entirely from the till plain.

The source of the Humber River is both on the escarpment and the Interlobate Moraine. Streams that have their source on the moraine have a much more regular flow regime maintaining a relatively strong base flow.

Most of the Lake Ontario Region streams are short, with large gradients and sharp valleys until they reach the level of former glacial Lake Iroquois. Average river gradients are 2.9 to 4.1 m per km for larger streams and up to approximately 12 m per km for headwater and small streams. The mean stream slope (weighted) derived from data for 31 stations in the region was 4.42 m per km with a standard deviation of 2.25 m per km.

These slopes ranged from 1.15 m per km for the Wilmot Creek (near Newcastle) to 9.42 m per km for the Duffins Creek (above Pickering). The western half of this region is the most urbanized area in Ontario. Urbanization has brought an increase in the flood potential, though the exact effects are difficult to determine. Floods pose almost a yearly hazard for some urban areas on the old lake plain because of the swift movement of runoff down the steep river gradients.

Region 8 is mostly within the South Slopes climatic region (Brown et al. 1968). Average mean annual temperature, precipitation and snowfall are 7.3°C (45°F), 812 mm (32 in.) and 178 cm (70 in.), respectively. A rain-shadow effect is evident just to the west of the Toronto area and average precipitation decreases to less than 711 mm (28 in.).

The mean values for the parameters of 41 (37) stations analysed which are influenced by the regional characteristics described in the foregoing are as follows:

Specific Mean Annual Flood (Q2 /A)	0.30 (.31) m^3/s per sq. km
Mean Annual Runoff (MAR)	304 (314) mm
Base Flow Index (BFI)	0.55 (.55)

( ) denotes data for heavily regulated stations not included.

REGION 9 - Trent-Severn System

Region 9 is delineated as the north slope of the Oak Ridges Moraine or the southern section of the Trent-Severn Drainage System. The Penetang Peninsula west to the divide of the Nottawasaga Basin has been included in this region. The vertical drainage in the porous soils of the uplands of the Penetang Peninsula is also characteristic of the Interlobate Moraine. North of the moraine is a fluted till plain, the Peterborough Drumlin Field, that is notable for the large number of drumlins or glacially deposited oval hills, formerly termed whalebacks.

In the west, the till contains great quantities of angular limestone rubble, while in the east the rubble decreases and there is a greater occurrence of large boulders of Precambrian origin. Deposits of clay lie between the drumlins in some areas that were flooded by the old glacial lakes. Similarly, lacustrine clays are found in the Trent River area because of inundation up the Trent Valley. Towards the south, the till is somewhat more sandy. The lowlands around the southern and western ends of Lake Simcoe are floored by sand, silt and clay deposited in a former glacial lake.

The well drained Otonabee group of loams has been mapped extensively over the till plain. Towards the moraine, the Guelph family of loams predominates. On the west and north of Lake Simcoe, the dominant well drained soils have been placed in the Vasey and Tioga families. The Tioga loamy sand is the most widespread on the Penetang Peninsula.

The river valleys of the Region are U-shaped and wide with varying amounts of swampy areas. The rivers are sluggish in the lowland and till plain and have shallow channels. The valleys are deep enough to provide excellent drainage for the upland hills. Average river gradients are moderate to large. The Holland and Schomberg Rivers fall an average of 1.65 and 1.29 m per km, respectively. In the Holland headwaters, gradients vary from 2.1 to 5.4 m per km. Streams with drainage areas of 260 km or less discharging into the Trent River have average slopes varying from 1.2 to 4.7 m per km.

The mean stream slope (weighted) derived from data for 13 stations in the region was 1.79 m per km with a standard deviation of 1.15 m per km. These slopes ranged from 0.42 m per km for the Beaverton River (near Beaverton) to 4.61 m per km for the Uxbridge Brook (at Uxbridge).

Representative values of mean annual temperature, precipitation and snowfall for the Simcoe and Kawartha Lakes climatic region, which makes up most of Region 9, are 6.2°C, 812 mm and 178 cm (43°F, 32 in. and 70 in.), respectively.

Being in the lee of Georgian Bay, the uplands of the Penetang Peninsula receive more precipitation. Average annual precipitation increases on the peninsula to more than 965 mm (38 in.) and snowfall to more than 285 cm (112 in.).

The median values for the parameters of 17 (12) stations analysed influenced by the regional characteristics described in the foregoing are as follows:

Specific Mean Annual Flood (Q2 /A)	0.13 (.16) m^3/s per sq km
Specific Mean Annual Runoff (MAR)	319 (313) mm
Specific Base Flow Index (BFI)	0.62 (.49)

( ) denotes data for heavily regulated stations not included.

REGION 10 - Canadian Shield, North Central Ontario

Region 10 is the area of the Canadian Shield continuing from the northern boundary of Region 1 to the Hudson Bay Lowland (HBL) at the north. The western boundary lies close to the northernmost shoreline of Lake Superior extending north-northwest to the Hudson Bay Lowland. The north-south boundary line for Quebec defines the eastern limit of the region. Like Region 1, this is an area of glacially scoured Precambrian rocks, rugged relief and forested lands. The soils are generally coarse-textured and formed on coarse, strong till, sand and gravel.

Generally the bedrock is located at a depth of 1 m or less. Pockets of sands and gravel of variable extent and depth are dispersed throughout the region with the more extensive deposits occurring in a band running just north of the Hudson Bay drainage divide. Further to the north, surfical deposits primarily silts and clay of port glacial origin occur in depths ranging from less than 1 m to over 30 m and extend into the Hudson Bay Lowland. A thick layer of muskeg generally covers the surface of flat low lying areas where silt and clay deposits usually occur.

The mean stream slope (weighted) derived from data for 25 stations in the region was 0.68 m per km with a standard deviation of 0.61 m per km. These slopes ranged from 0.042 m per km for the Kenogami River (at Kenogami dam) to 2.99 m per km for the Farr Creek (at North Cobalt).

The mean annual precipitation is over 1000 mm (39.4 in.) for the area bordering the northeast shore of Lake Superior, but decreases further inland to under 750 mm (29.5 in.) giving an average value just over 800 mm (31.5 in.). Mean annual snowfall follows a similar but less pronounced pattern going from under 200 cm (79 in.) to over 400 cm (157 in.) giving an average of approximately 375 mm (148 in.). Mean annual temperatures vary from approximately -1°C (30.2°F) to more than 2.5°C (36.5°F).

The median values for the parameters of 37 (13) stations analysed which are influenced by the regional characteristics described in the foregoing are as follows:

Specific Mean Annual Flood (Q2 /A)	0.06 (.10) m^3/s per sq. km
Mean Annual Runoff (MAR)	364 (384) mm
Base Flow Index (BFI)	0.66 (.67)

( ) denotes data for heavily regulated stations not included.

REGION 11 - Canadian Shield, Northwestern Ontario

Region 11 is the area of the Canadian Shield continuing from the northwestern boundary of Region 10 as far as the Hudson Bay Lowland to the north and east. The provincial and international borders define the western and southern limits. This region is very similar to Region 10 in terms of physiography; however, it is typified by the occurrence of more numerous and larger lakes and of several large pockets of silt and clay in the vicinity of Dryden and Atikokan.

The mean stream slope (weighted) derived from data for 36 stations in the region was 0.76 m per km with a standard deviation of 1.12 m per km. These slopes ranged from 0.02 m per km for the Kawinogans River (at Pickle Crow) to 4.14 m per km for the McIntyre River (at Thunder Bay).

The mean annual precipitation and snowfall is somewhat lower than Region 10. The mean annual precipitation varies from a maximum of over 800 mm (31.5 in.) to under 550 mm (21.7 in.) with an average value of approximately 650 mm (25.6 in.). Mean annual snowfall varies from less than 200 cm (79 in.) to 356 cm (138 in.) having an average of approximately 250 cm (98 in.). Mean annual temperatures vary from approximately -4°C (25°F) to more than 2.5°C (36.5°F). The entire area north of Pickle Crow and Deer Lake lie within the permafrost region but experiences discontinuous permafrost.

The median values for the parameters of 52 (31) stations analysed which are influenced by the regional characteristics described in the foregoing are as follows:

Specific Mean Annual Flood (MAR/A)	0.02 (.03) m^3/s per sq km
Mean Annual Runoff (MAR)	273 (287) mm
Base Flow Index (BFI)	0.83 (.87)

( ) denotes data for heavily regulated stations not included.

REGION 12 - The Hudson Bay Lowlands

Region 12 is the entire area of the Hudson Bay Lowland. The Tyrrell Sea formerly covered most of this area in the post-glacial era during which various sedimentary deposits were laid down. Consequently, the area is very flat with a seaward slope of approximately 0.35 m per km. A large percentage of the area (approx. 85%) is wetland having vegetative cover ranging from closed boreal forest at the southern boundary to open sub-arctic forest to heath-fenland along the Bay. This cover is rooted in peat deposits having depths ranging from less then 2 m in the Bay area up to 5 m further south. These deposits and other unconsolidated sediment occur in depths of over 12 m and are underlain by till of varied composition. These till deposits generally overlie consolidated sedimentary deposits and peat from the pre-glacial period. Sedimentary bedrock underlying these deposits are primarily limestone and dolomite, predominantly Silvian with some of Devonian in the Albany River and Moose River Basins. Some overlying Cretaceous shale deposits also occur in the Moose River Basin. Precambrian rocks outcrop in pockets at seal level in the area between the outlets of the Winisk and Attawapiskwat Rivers.

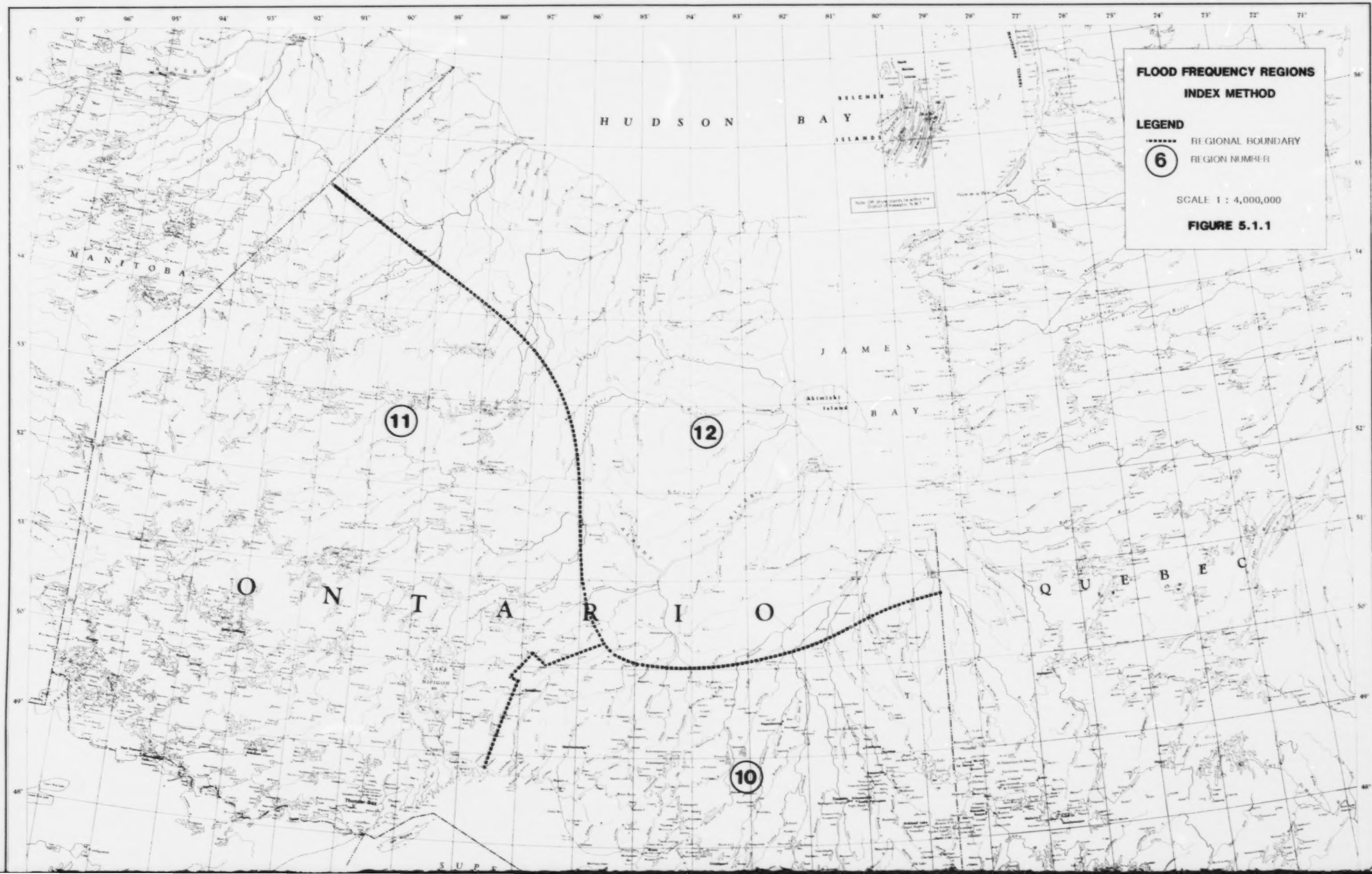
The mean stream slope (weighted) derived from data for 11 stations in the region was 0.78 m per km with a standard deviation of 0.86 m per km. These slopes ranged from 0.07 m per km for the Albany River (near Hat Island) to 3.22 m per km for Shamattawa River (at outlet of Shamattawa Lake).

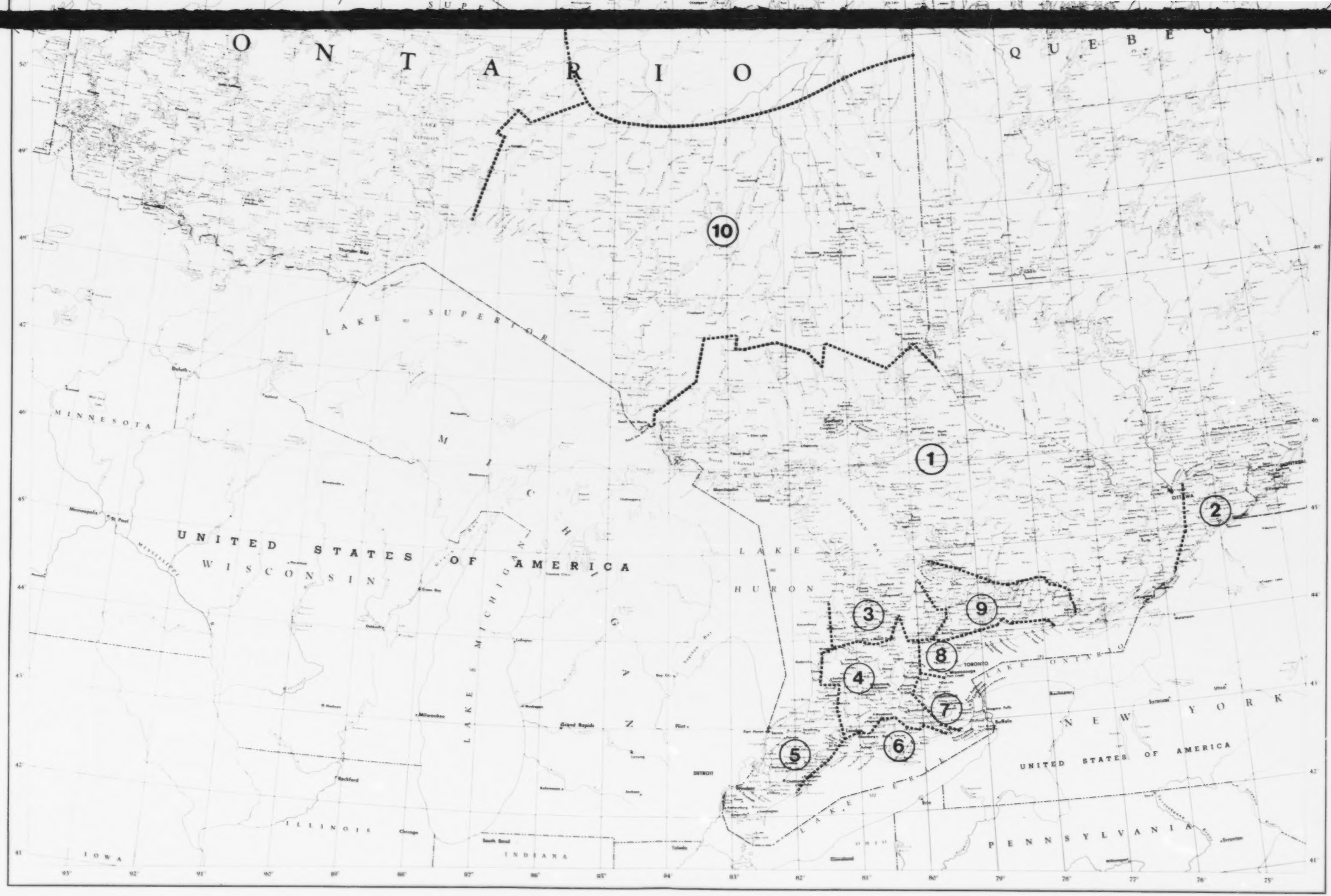
The mean annual precipitation over this region ranges from under 500 mm (19.7 in.) to over 750 mm (29.5 in.) with an average of approximately 650 mm (25.6 in.). The mean annual snowfall varies from under 250 cm (98 in.) to over 350 cm (138 in.) giving an average of approximately 325 cm (138 in.). Mean annual temperature varies from approximately -6°C (21°F) to over -1°C (30°F). The area north of Moosonee lies entirely within the permafrost region but continuous permafrost only occurs in the coastal areas where depths of up to 30 m are estimated.

The median values for the parameters of 11 (9) stations analysed which are influenced by the regional characteristics described in the foregoing are as follows:

Specific Mean Annual Flood (Q2 /A)	0.07 (.07) m^3/s per sq km
Mean Annual Runoff (MAR)	339 (300) mm
Base Flow Index (BFI)	0.66 (.69)

( ) denotes data for heavily regulated stations not included.


FLOOD FREQUENCY REGIONS
INDEX METHOD
LEGEND
REGIONAL BOUNDARY
6
REGION NUMBER
SCALE 1 : 4,000,000
FIGURE 5.1.1
HUDSON BAY
JAMES BAY
MANITOBA
ONTARIO
QUEBEC
11
12
10


ONTARIO
QUEBEC
LAKE SUPERIOR
LAKE NIPIGON
MINNESOTA
UNITED STATES OF AMERICA
WISCONSIN
LAKE MICHIGAN
LAKE HURON
LAKE ERIE
LAKE ONTARIO
NEW YORK
PENNSYLVANIA
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St. Paul
Rockford
Milwaukee
Chicago
Grand Rapids
Flint
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South Bend
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Cleveland
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